The Welding Engineer

Edited by L. B. Mackenzie

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ANYTHING and EVERYTHING for OXYACETYLENE WELDING and CUTTING

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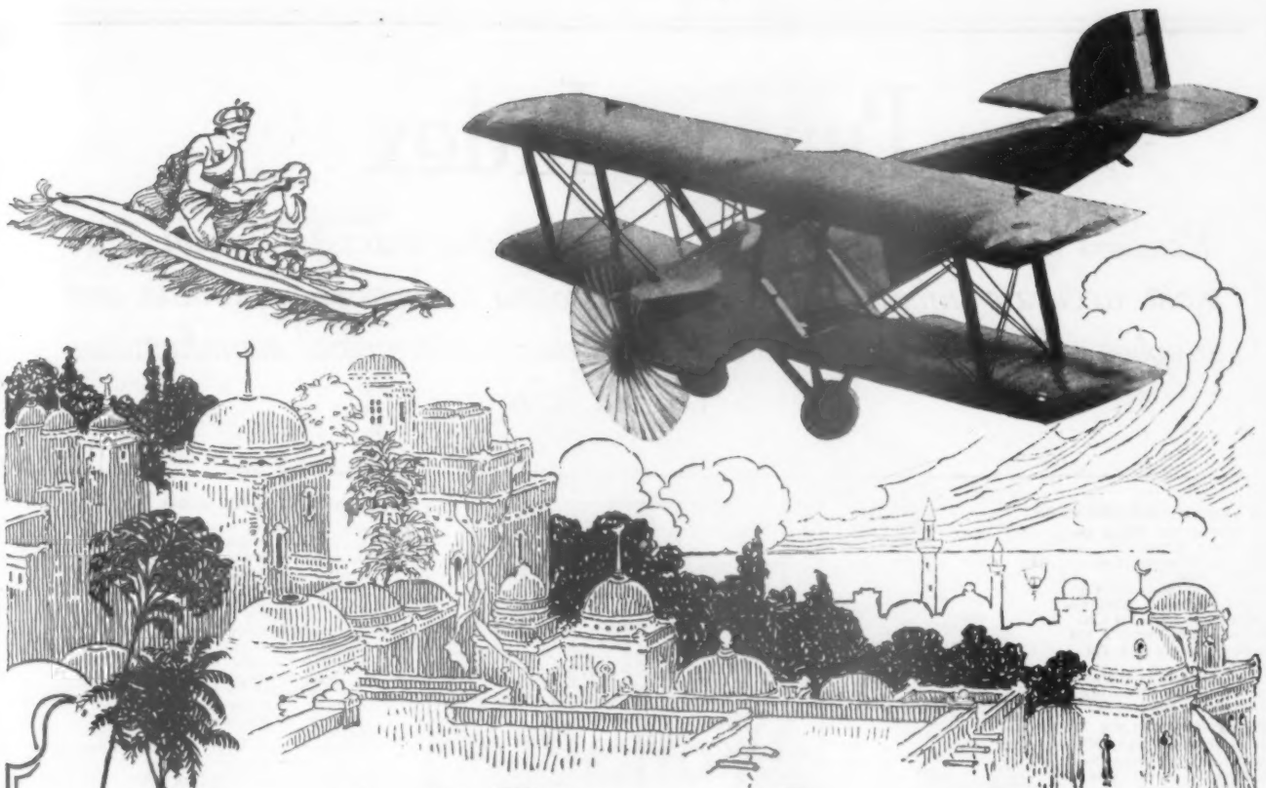
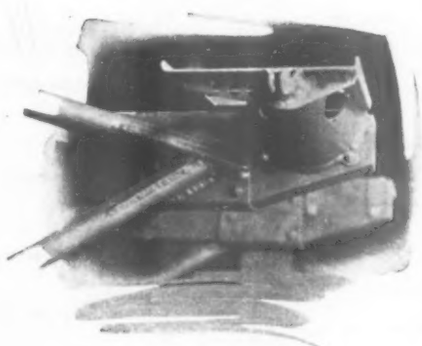


Bagdad's Dream Comes True



FACTS are sometimes stranger than fiction and the Magic Rug fairy story of the Arabian Nights is tame compared to the true story of the United States Army's Round-the-World flight.

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Torches"

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Purox Co.
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United States Welding Co.

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Purox Co.
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Davis-Bournonville Co.
Harris Calorific Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Alexander Milburn Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
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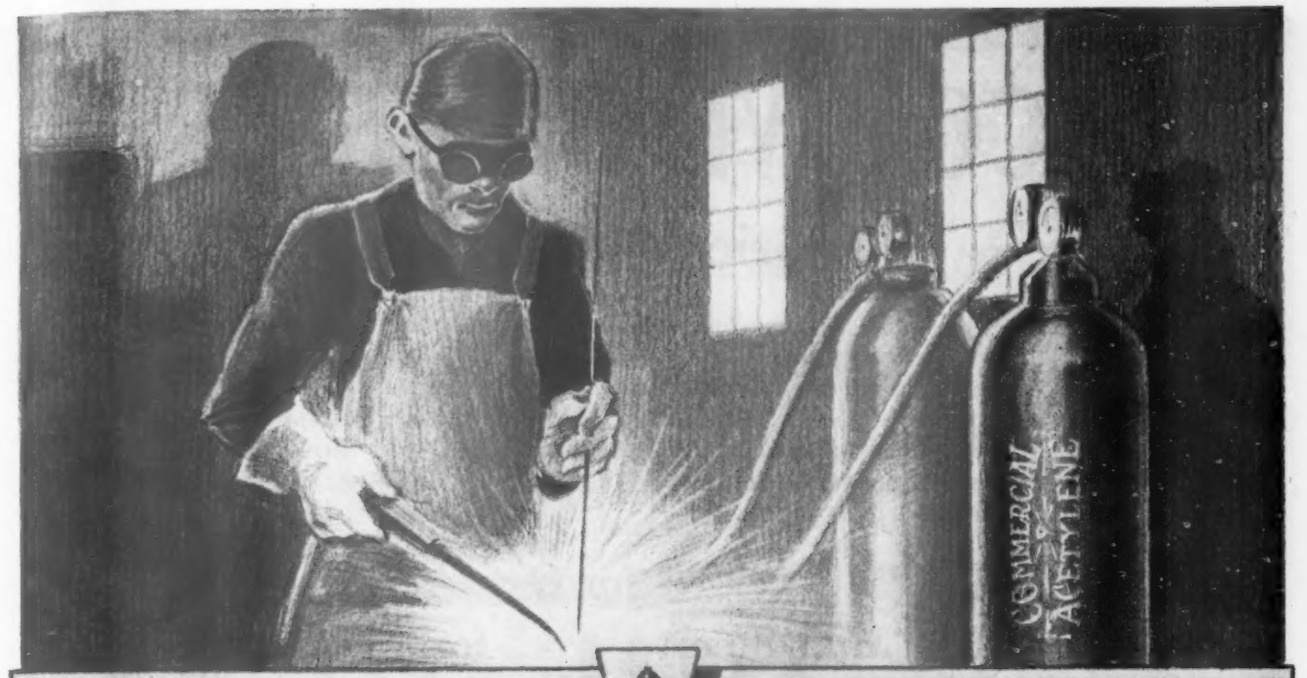

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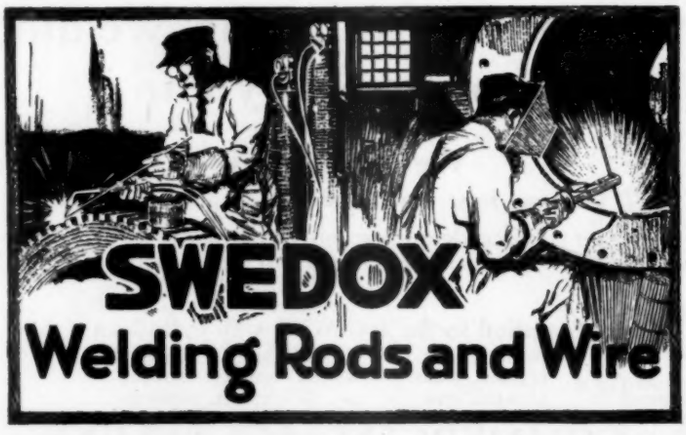

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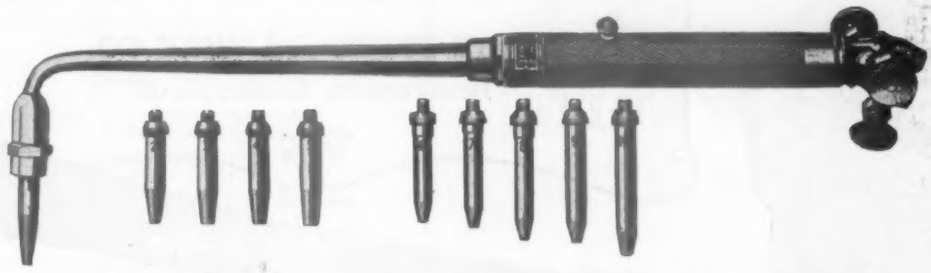

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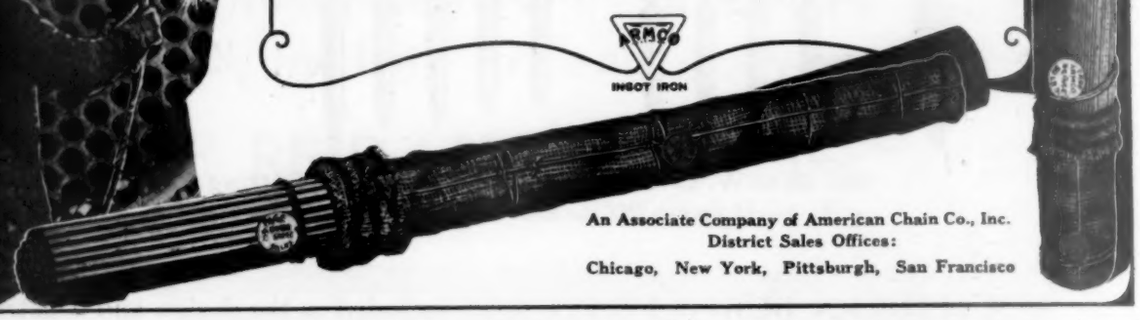

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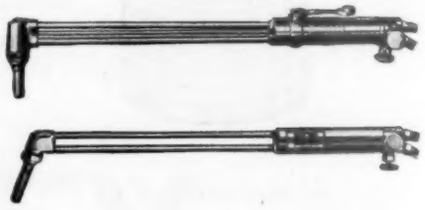

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Number of Cutting Torches in use	7	5
Tips bought this year (8 months)	$92.50	$67.50
Average per month	11.57	8.44
Average per month per torch	1.65	1.69

These torches are in constant service, sometimes both day and night, on such work as would be found in a car shop, steel foundry or heavy equipment manufacturing plant.

All sorts of repair work, light and heavy, clean and dirty, as well as new work and cutting heavy castings are done at these plants.

Torchweld Staylit Non-Flash Metal Cutting Torches are made in two styles, i. e., either one or two piece tip construction to meet every operating or production requirement.

Send for Catalog 23-E

TORCHWELD EQUIPMENT COMPANY

224 No. Carpenter St. **Chicago, Ill.**

Why McGraw carries 25 men

NINE MEN are all that can play at any one time. The rest are insurance. A player may be injured—McGraw has a reserve supply. The turn of the game may require a pinch hitter—McGraw calls on the bench. It is this knowledge of his reserve forces that enables McGraw to play a winning game.

Oxygen for your day's needs is all that is necessary to run your plant. Your Linde contract is insurance. One oxygen plant may break down—Linde has a reserve supply. An increase in your business may require an excess of oxygen—Linde calls on any or all of its 115 plants and warehouses. It is this knowledge of Linde's reserve forces that enables you to be free from worry over oxygen—if you are a Linde customer.

Linde uses its team

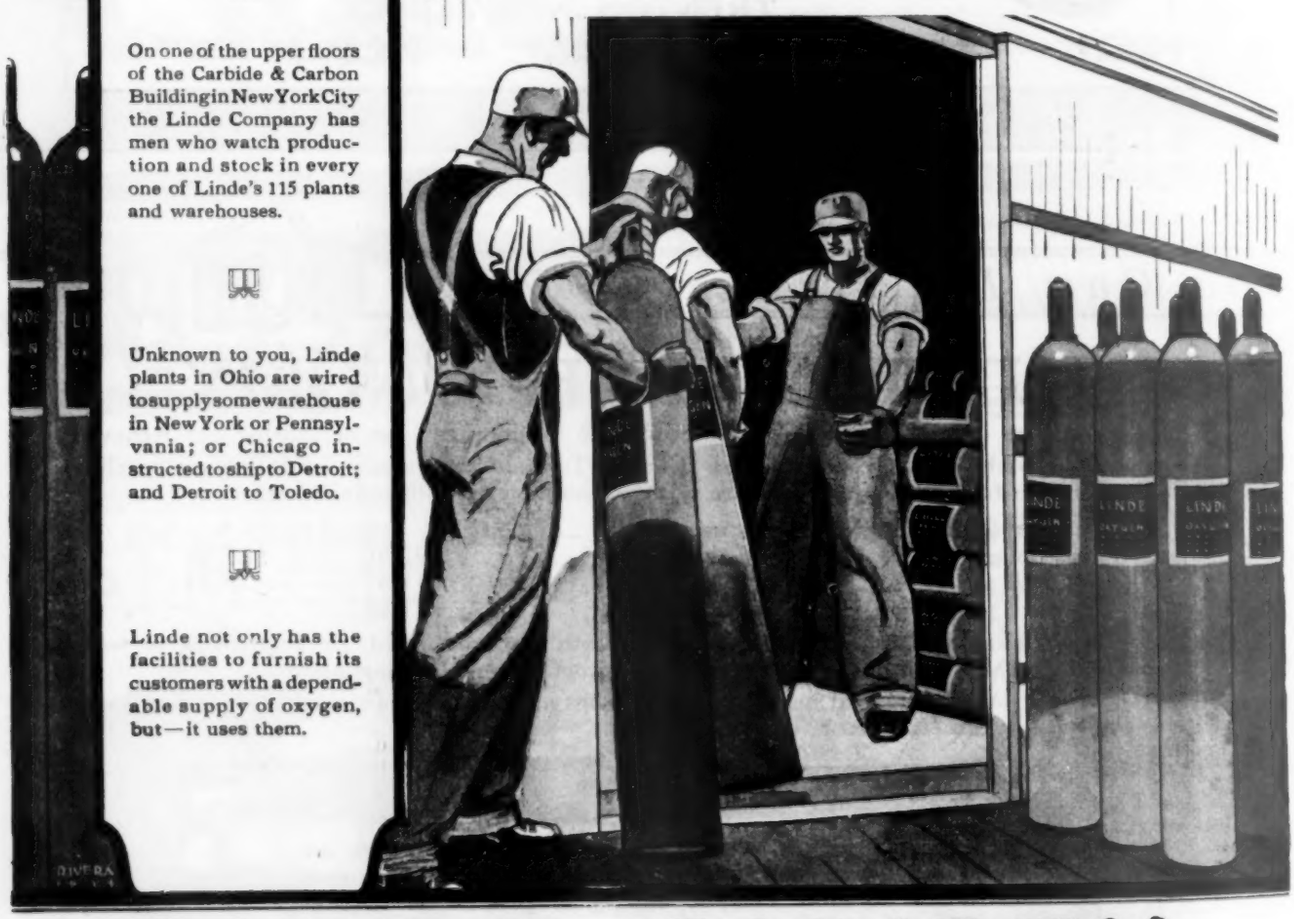
The Linde team of 115 plants and warehouses would be of little advantage to you if Linde did not play the game and use these plants and warehouses for you.

On one of the upper floors of the Carbide & Carbon Building in New York City the Linde Company has men who watch production and stock in every one of Linde's 115 plants and warehouses.

Unknown to you, Linde plants in Ohio are wired to supply some warehouse in New York or Pennsylvania; or Chicago instructed to ship to Detroit; and Detroit to Toledo.

Linde not only has the facilities to furnish its customers with a dependable supply of oxygen, but—it uses them.

THE LINDE AIR PRODUCTS COMPANY
General Offices: Carbide & Carbon Bldg.
30 East 42d Street, New York
38 PLANTS—77 WAREHOUSES



LINDE OXYGEN

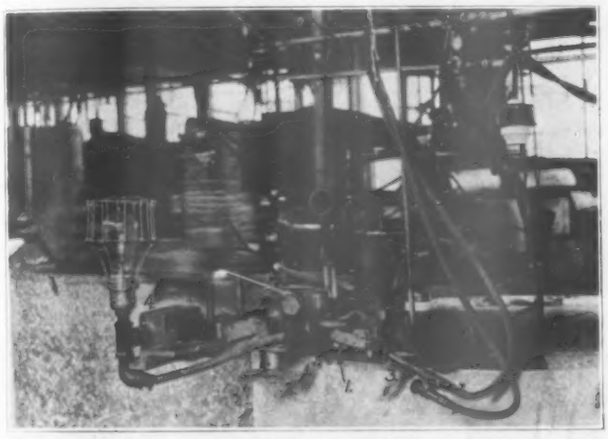
YOU CAN DEPEND ON THE LINDE COMPANY

AUTOMATIC WELDING OF TANKS

New Machine Automatically Welds Circular End Seams—Revolves Around Work—Flame Ocillates—Boosts Production

THE automatic welding of straight and circular seams has been developed by the Milwaukee Tank Works, Inc., Milwaukee. This company manufacturers underground storage tanks of various sizes up to 56 inches in diameter, and also lubricating oil pump tanks, 22 inches in diameter.

Necessity, the alleged mother of so many inventions, is again responsible for the conception of these machines. Formerly the circular seams at the Milwaukee plant were welded by hand, but large scale production of an article steadily increasing in demand, and one requiring flawless seaming of sheet metal made more evident the need of welding beyond the quality and speed of hand work. According to Edgar A. Bienenstok, president of the Milwaukee Tank Works, Inc., several months were spent in scouting around the country in the hope of buying a machine that



Photograph A—The Circular Machine Ready to Weld End Seam on 56-Inch Tank

would meet the requirements of the particular work done by the company. The search failing to reveal any such device on the market, the manufacturers resorted to the only alternative—building the machine themselves.

About seven months ago, patents having been secured, the machines were installed in the Milwaukee plant, and at the present time there are fourteen in operation there.

The patents on the machines cover two features in particular, the oscillatory movement of the torch across the weld, and (on the circular machines) the guiding of the torch by the rim of the tank. The manufacturers recognize that there are several types of automatic machines for straight seam welding, but they believe that they are probably the only plant welding circular seams automatically.

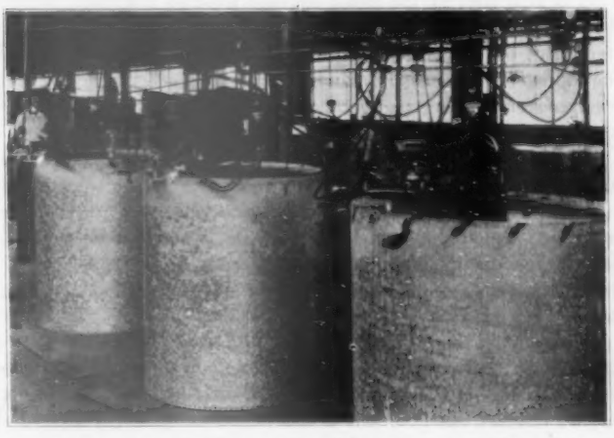
Recently the writer had occasion to see these machines in operation and observe the quality of work done by them. The welding being done at this particular time was on galvanized iron, 3/16 of an inch thick, the material from which the larger underground tanks are made. Previous to being set for circular welding of the end seam, the end had been placed in the shell with the flange outward and flush to the edge of the shell, being held in place by spot welds.

Photograph A shows one of the circular welding machines mounted on the tank about to be welded. The torch (1) is lighted and regulated by the operator, and the motor is then started. Contrary to what one might suppose, the course of the machine is not determined centrally—that is, the torch is not held on any arm or radius maintained at the center of the tank end. The machine is guided by means of a wheel rolling along the outside of the tank (2), and one rolling along the inside of the seam (3), together with the course taken by a claw wheel which draws the machine around the top of the tank.

This claw wheel (5) is shown in photograph B. It is driven by the electric motor and its direction is in a line of direct pull against the line of the two controller wheels. By this means the two wheels are kept firmly against their respective sides of the tank rim, and the torch is maintained constantly along the line of the seam. This arrangement, according to the manufacturers, makes for further efficiency in the reducing of the necessity of regulating, it being claimed that one setting of the claw wheel will handle anything from 30 to 60 inches in diameter. The arm (6) is a balance lever, mounted on a ball bearing and socket, but other than being a steadying force, has no control over the movement of the torch.

As the torch moves along it oscillates evenly across the seam producing a steady flow of metal, and a neat, uniform, clean solid weld. This cross movement has a special asset in flowing the metal together where seams have spread due to expansion. In the work done at Milwaukee no welding wire is used, and it is claimed that it is not necessary to bevel or lap the pieces to be welded, all work being simply butted together.

Sheet metal from 16 gauge to a quarter inch in thickness may be handled in this fashion, and since none of the work done by the Milwaukee plant is more than three-sixteenths of an inch in thickness, the need for welding wire is absent. The makers of the machine point out, however, that on larger metal welding wire is needed. If the metal is more than a quarter inch thick



Photograph B—Battery of Circular Welders In Operation

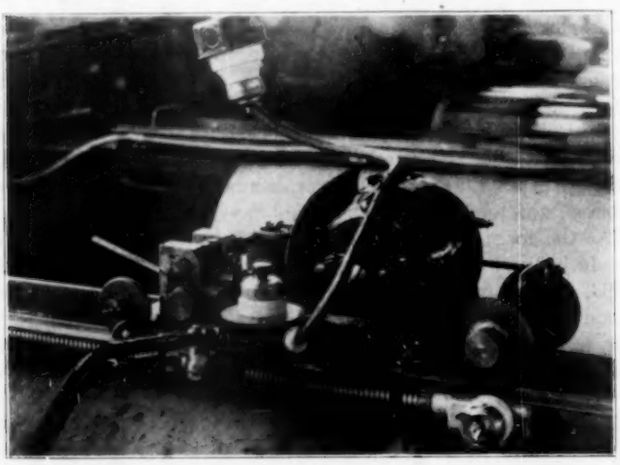
it is advised that the edges be beveled before being butted. Then the welding wire may be layed flat into the groove made by the bevel in each piece and the machine set to work over the seam. This system eliminates the necessity of feeding the wire vertically, by hand or otherwise. This can be done, of course, with the straight seaming machines, and can also be done with the circular machines, but in the latter case the inner side of the shell and the outer side of the flange must be beveled.

These machines are equipped with automatic stopping devices, (4), shown in photograph A. After the machine has been set in operation, a clamp is fastened to the rim at the point where the welding began. As the machine progresses around the machine and finally comes back to the starting point, it meets the clamp which stops the machine, throws the torch off the work, and lights a bulb, attracting the attention of the operator.

The efficiency of the machines from a production standpoint is evident when one sees a battery of them in operation. By vir-

tue of the stopping device, which is supplied with both the circular and straight seam machines, one operator is able to oversee several machines, depending on the size of the tank and the speed of the machine. No statements are given as to the speed of these machines since the experience and intelligence of the operator in setting his torch and adjusting the machine are vital factors.

Nevertheless, there is a decided value in the machine's continuous operation. The work progresses at the rate of about four inches per minute, and the larger the tanks, the more machines may be handled by one operator. As an example, on the straight seaming machines in the Milwaukee plant, welding seams on small tanks thirty-six inches long, one operator can



Photograph C—Close-up of the Straight Seam Welder

handle only three machines, due to the fact that frequency of loading and unloading work prevents handling any larger number. This is also true of the small circular welding machines, welding the end seams on the smaller tanks, twenty-two inches in diameter. But on the larger work—the fifty-six inch diameter tanks, one operator may easily handle four or more, since the time required for welding one job is sufficiently long to allow loading and setting up more tanks and adjusting the machines on them.

The feature of the oscillatory movement of the torch must not be slighted. By this means a very steady and smooth flow of metal is obtained, and the weld which results is clean and uniform. On the galvanized metal the weld penetrates about three-sixteenths of an inch deep. On the black iron, which is more aggreeable to welding, the seam is smoother and more uniform.

The rate of four inches per minute, previously mentioned, is by no means constant or fixed. Up to a certain point the speed of the machine may be lowered or raised to suit any requirement. On the circular machine this is accomplished by the claw wheel. This wheel is advanced along its arm toward or away from the center of the tank. If it travels close to the center the speed of the torch on the circumference is greater than when the wheel travels near the circumference, the rate of the claw wheel being always constant.

Photographs C and D show the straight seam welders. Here, too, the torch oscillates as it moves along the line of the seam. Photograph D shows some of the thirty-six inch tanks being welded. These shells are brought to the machines and placed under the clamp, which is also the carriage for the machine. These shells are neither beveled nor lapped at the seam. They are merely butted together and held in the clamp while the torch moves along and welds them, no welding wire being used.

The only limit to the size of work which may be done by the straight welders, the makers state, is the size of the clamp, itself, since it is the carrier for the chassis of the welding machine. This clamp is part of the regular equipment of the machines used in the Milwaukee Tank Works, although they are not standard equipment with all the machines.

Automatic stopping devices, similar to those on the circular machines, are also supplied with the straight machines. The principle is the same as that used on the stopping devices on the circular machines—a stop clamp, a switch, and a lighting bulb which arrests the attention of the operator. The chassis of the straight welder may be lifted by hand and made to retrace the weld. It may be reset at any part of the weld desired.

The tank manufacturers have found gas welding best suited for their specific purposes, and that is the type used throughout the plant. They have their own gas generator and system, which feeds the different machines through tubes shown in the photographs. Gauges may be seen on the tubes above the machines, and the regulation of the flame is taken care of near the connection of the tubing and the torch iron.

The accompanying photographs may serve to convey the construction of these machines. They are not heavy, and when not in operation, they are suspended on pulleys, by means of which the operator is able to lift them from the tank when the welding is finished.

The human element has been reduced to a minimum by these machines, and accordingly the chance for mistake and error has been greatly removed. The work of the operator in handling these machines consists chiefly of loading and unloading. When he has learned to regulate the gas and oxygen flame to the proper composition, he is qualified to handle a battery of these machines. In addition to this all that is expected of him is to set the tank in place, start the machine, and remove the tank when the stop signal has informed him that the weld has been completed.

To see the sort of weld accomplished by these machines banishes any doubt that it is superior to hand work. Even if hand work were on a par with the welding done automatically, the

Photograph D—Straight Welders on 36-Inch Seams

element of speed should not be overlooked. Granting that a hand welder might possibly be able to weld such seams as those welded in the Milwaukee plant at the rate of four inches per minute, and with the same smoothness and regularity—he could not, as the machine does, go clear around a tank fifty-six inches in diameter without stopping. The best any welder can do is a few inches at a time. The strain of the work necessitates intermittant, brief pauses. The human machine, due to its frailty, demands such relief from anything taxing nervous energy as metal welding does.

But while these pauses are being taken, small though they be, time is flying and the torch is burning. Fuel is going to waste when it might be utilized in production. The automatic welder possesses none of the human frailties. It requires no intermittant pauses, having no nervous system to respect, and so it moves

constantly along the seam and as long as the torch burns, it is welding.

Of course, there is the production factor. Where tanks are turned out in large quantities daily with uniform regularity, satisfaction is assured. The operators in the plant are all men who knew nothing about welding before being set at these machines.

According to Mr. Bienenstok, the plans of the company at present are to manufacture the machines and lease them. Most of the machines made so far are in operation in the Milwaukee plant. There are a few elsewhere on experimentary trials, but as yet the marketing of them has not been extensive.

With the exception of one, all the machines thus far have been designed for gas torches. This is due to the fact that this plant, in welding tanks, preferred the soft gas weld to the electric arc, and being designed for the plant's specific needs, the gas torch has been used rather than the arc.

However, the manufacturers claim that they are able to equip these machines for electric arc welding as well as gas welding. They advise and recommend the use of gas torches on these machines, citing as their reason the expense of installing electrical transformers. So far the company has built one machine for electric welding. This machine was built especially for a friend of the members of the Milwaukee corporation, and although the machine has not been long in operation, reports on it are said to be favorable. It uses self-feeding carbons.

While the machines may be designed for both gas and electric arc welding, obviously they cannot be adapted for cutting sheet metal. In order for this automatic welder to move along a line or seam there must be a rim by means of which the machine is guided. The very nature of the machine and one of the features contained in its patent—that of the torch being guided by the rim of the tank—makes it unsuitable for the majority of cutting work. Only where there is some sort of a rim, such as that furnished by the flange on the tank heads, which would guide the machine on its circular path, could the machine be used for cutting. Most circular cutting, however, is done where no such rim or flange exists.

Another reason why the machine cannot be adapted to cutting is that the other feature of it—the oscillating torch—would not be suitable. For cutting, the torch would have to be maintained on a steady course, and in so steadying the torch and removing the oscillatory movement the machine would not possess the feature on which it was patented.

Undoubtedly, metal cutting is beyond the field of these newly designed machines. There are several makes of automatic cutting machines already performing this phase of metal construction and fabrication. Most of them hold the torch in a constant position and the work, itself,—the piece to be cut—automatically is revolved about a central point.

The automatic welding machines designed at Milwaukee, do the moving or revolving, while the work remains stationary, and there is no central regulation nor describing of a circle by a radius arm. This welding machine they say is something different, and has a special field—the welding of tanks on which the ends are flanged and placed outward.

"Tank welding constitutes a highly appreciable part of the welding industry today, and when the production of this article can be improved and made more profitable, there is a place and demand for the force which makes possible that improvement and increase in profit," says Mr. Bienenstok. This is what the manufacturers of the new automatic welding machines believe they have developed. They designed the machine originally to meet their own needs—to further facilitate the production of their standard product. The machine has accomplished the desired result and for seven months all such work has been totally turned over to these machines.

Photograph E—Battery of the Larger Circular Welders. Notice Daylight Working Conditions

ENGINEERING IN AMERICAN INDUSTRY

Engineering in American Industry is a new book by Conrad Newton Lauer. This book is sold by the McGraw-Hill Co., New York City. It sells for $2.50. It deals with the American industry in the United States during the last 120 years. Mr. Lauer is a member of the American Society of Mechanical Engineers, American Academy of Political and Social Science, Franklin Institute of Pennsylvania, National Electric Light Association, Newcomen Society, London. He is the general manager of Day & Zimmerman, Inc. This book is very attractively printed on very fine paper and it has a cloth binding. It consists of 95 pages, is attractively illustrated throughout and has many very interesting charts and grafts. It is 9x12 inches in size. This book makes a very good looking volume to have on the office desk, and the information it contains is authentic, interesting, and very much worth-while.

The Mid West Oxygen Company, Portsmouth, Ohio, was elected an active member of the Gas Products Association at a recent meeting of the Executive Committee. This company is Mr. M. Keith Dunham's plant.

H. D. Rohman, of the R. C. S. Equipment Company, 8 East 41st Street, New York City, has taken over the agency of the Electric Arc Cutting & Welding Company for the Taperod electrodes on the Interstate Steam Railways.

ARC WELDING HEAVY PLATE

Arc Welding of Heavy Plate Can be Successfully Done if Correct Methods are Used—Three Fundamental Principles Must be Followed

By H. P. EAGAN*

THERE has been considerable discussion as to whether or not heavy plate can be successfully arc welded, that is—can you weld heavy plate and always get a tight weld, no warping of the plate and at the same time 100 per cent strength. The answer is yes—if the correct method is used.

The correct method of welding involves three fundamental principles:

First—The joint should be accomplished with the minimum amount of welded material between the edges to be joined.

Second—The reinforcement on one side seam should be equal to the reinforcement on the other side so that when the stress

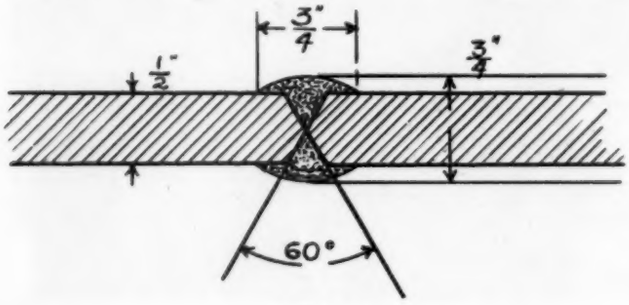


FIG. 1

Correctly Designed Joint

is applied there is no distortion of the plates due to the tendency of the center line of the material to pull into coincidence with the center line of the stress.

Third—Residual strain should be compensated for by the use of step-back welding on plates half inch thick or less and by the use of step-back welding peening of the metal on 5/8 inch thick plate or over. These principles will be discussed in the above order.

As a general proposition, in order to obtain 100 per cent efficient joint with arc welded construction, the plate should be butted together and the bevel should not exceed 60 degrees total opening. The section of welded material between the edges to be joined should be 50 per cent in excess of the section of the members being joined. (See figure 1.) All these factors must be taken into consideration in making the weld. For instance, the provision of 50 per cent excess section may be followed and still a 100 per cent joint not obtained. To illustrate this, on half inch plate if the bevel is made 90 degrees total opening and the plates left quarter inch apart, making the total weld about 3/4 inch wide, the strength of the weld will approximate only 60 per cent.

The second principle is self-evident. There are, however, occasional repair jobs where the welding can be done only from one side. The making of a butt seam will frequently require a considerable amount together to assure a good weld. In cases of this kind a patch with a scalloped edge will be used. This type of construction is illustrated by Figure 2. A patch should never be welded from one side only without the use of the scalloped edge, for the reason that there is no welding at the point of greatest stress. This type of construction is used principally in connection with repair work and there is very little application in manufacturing new material.

The third principle, step-back welding, is somewhat more complicated. (Step-back welding in principle is illustrated in Figure 3.) In general tank-building practice it is customary to make a section of the step-back weld longer than the section which would be made in the case of a boiler repair job. However, in no case should the section exceed 12 inches in length.

The use of the step-back welding method will eliminate to a

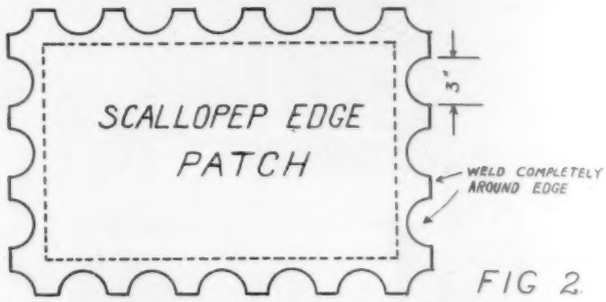


FIG 2.

Methods of Making Strength Weld Which Operators Can Work From One Side Only. Make Template to Cut Edge With Torch

large extent the badly distorted jobs which some shops get, due to the fact that they do not use this method. It should always be used by the operator building any kind of a tank, not only as a matter of reducing the distortion of the tank, and spoiling its looks, but also as a matter of improving the quality of the joint. If a large amount of locked up strain is left in the joints the usual strength of the weld will be materially reduced.

Step-back welding does not in any way decrease the speed at which the work may be done, since it is merely a matter of

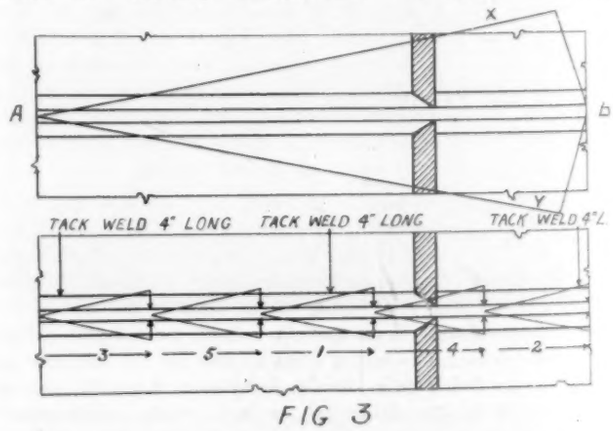


FIG 3

Principles of Step-Back Welding. The Object of the Step-Back Welding Method is to Reduce the Effect of Contraction in Seam Welding. Seam in Top Diagrams Welded From A to B. Lines X and Y Show Accumulation of Contraction Strains. Lower Diagram Shows Same Seam Welded by Step-Back Method. After Tack Welds Are Made, Seam is Welded in Sections as Shown. Contraction Stress Does Not Reach Such a High Value. It Does Not Accumulate as the Weld Progresses.

sequence of doing welding and has no connection with pounds of metal deposited per hour or the type of joint made.

There are two methods of compensation for the residual strain which would otherwise be obtained in a weld. One is step-back welding and the other is by opening the deposited metal with an air tool. On large tanks made of 1/2 inch or less material the step-back welding will in 99 per cent of the cases take care

*The Lincoln Electric Company.

of the matter of residual strain sufficiently well for all practical purposes. On plate 5/8 inch thick, or thicker, however, there is sufficent stiffness to the plate section to make it advisable to relieve the residual strain to the maximum possible degree, and in this case the metal should be put on in layers and it should be peened with an air tool between layers using a rough tool. Failure to do this will give a weld which is 30 to 40 per cent less in tensile strength than would be estimated on the basis of the section of welded material in the joint.

The peening of the deposition metal is done immediately after it has been deposited. It is usually impossible to peen the metal while it is still hot enough to show color, but it is sufficient for practical purposes to peen it as each section of the metal as put on by the step-back method is completed.

The peening operation should not be carried on to the point at which the metal is badly upset and damaged. When the surface is fairly rough, it may be assumed that the peening operation is completed. The peening operation adds about 20 per cent to the cost of doing the work as compared to doing it without.

Electric arc welding practice has been widely adopted in the application of tank steel, but there has been an increasing number of cases in which the tank shops have not been able to get satisfactory results in the welding of heavy plate. If, however, the three fundamental principles outlined above are followed, these difficulties to a large extent will disappear.

AMERICAN WELDING SOCIETY ANNOUNCEMENT

Formation of a Local Section of the American Welding Society

Under date of February 28, 1924, a meeting was held at the Aviation Club in Detroit to discuss the advisability of forming a local Section of the American Welding Society, and it was the sense of those present at that time that action should be taken toward that end in that the nearest Section is now located in Cleveland (too far away to be of service to Detroit and contiguous territory) and that the advantages accruing from such a Section would insure to the benefit of the manufacturers of welding supplies and equipment and to the users of the same referring particularly to the matter of standardization of supplies and equipment; and would further the use of standard specifications and methods as well as hasten the broadcasting of information pertaining to the welding art. The Detroit Section would act as a clearing house for information pertaining to and touching upon welding matters.

Temporary officers of the Detroit Section were elected as follows:

Temporary Chairman—H. M. Gould, assistant general manager, Department of Street Railways.

Temporary Secretary and Treasurer—C. L. Finch, Detroit Range Boiler & Steel Barrel Co.

Temporary Chairman Membership Committee—O. L. Smith, Weldit Acetylene Company.

Temporary Chairman Charter Committee—S. H. Calender, Air Reduction Sales Co.

At a meeting of the Executive Committee (consisting of the above mentioned) the following appointment was made which carries with it membership in the Executive Committee:

Temporary Chairman, Meetings and Papers Committee—A. W. Fry, Charles A. Strelinger Co.

For your information, there is given below a brief outline of the history and purpose of the American Welding Society.

In the year of 1916 there was established, under the auspices of the National Academy of Sciences, the National Research Council, which is a co-operative organization of scientific men of America, together with business men interested in engineering and industry. The aim of this Society at the time of organization was to co-ordinate the research facilities of our country on war problems. So well did it function, that in 1918 by executive order of the President of the United States, the Council was reorganized as a permanent body for the promotion of scientific research and of the application and dissemination of scientific knowledge for the benefit of the national strength and well-being.

In December, 1919, the Carnegie Corporation donated $5,000,000.00 for the financial support of the administrative work in connection with the activities of the Council.

This Council is divided into thirteen divisions, one of which, the Division of Engineering, aims to carry out the general purpose of the Council in co-ordinating different principles without discouraging individual initiative.

A subdivision of the Engineering Division of the Council is the American Welding Society, organized for the purpose of getting the most and best information possible from and to as many interested in and users of welding as possible.

The present national officers of the American Welding Society are:

President—E. H. Ewertz, general manager plant, Bethlehem Ship Building Co., Elizabeth, N. J.

Vice-President, New York and New England Divisions—T. A. Wry, General Electric Co., Lynn, Mass.

Vice-President, Middle Western Division—H. S. Mann, Metal and Thermit Corporation, Chicago, Ill.

Vice-President, Middle Eastern Division—J. D. Conway, Railway Supplies Mfrs. Assoc.

Vice-President, Pacific Coast Division—A. V. Thompson, General Electric Co., San Francisco, Cal.

Vice-President, Southern Division—C. L. Jones, Westinghouse Elec. & Mfg. Co., Atlanta, Ga.

Treasurer—C. A. McCune, Page Steel and Wire Company, Bridgeport, Conn.

Secretary—M. M. Kelly, 33 West 39th St., New York City.

Director, American Bureau of Welding—C. A. Adams, Professor of Electrical Engineering, Harvard University, Cambridge, Mass.

Chairmen, National Research Committees

Electric Arc Welding—Chairman, H. M. Hobart, General Electric Company.

Gas Welding—Chairman, S. W. Miller, Union Carbide & Carbon Research Laboratories.

Welding of Storage Tanks—Chairman, J. C. Lincoln, Lincoln Electric Company.

Pressure Vessels—Chairman, H. L. Whittemore, U. S. Bureau of Standards.

Standard Tests for Welds—Chairman, F. M. Farmer, Electrical Testing Laboratories.

Welding Wire Specifications—Chairman, C. A. McCune, Page Steel and Wire Company.

Training of Operators—Chairman, J. C. Wright, Federal Board for Vocational Education.

Resistance Welding—Chairman, Hermann Lemp, General Electric Company.

Thermit Welding—Chairman, J. H. Deppeler, Metal & Thermit Corporation.

Welded Rail Joint—Chairman, G. K. Burgess, U. S. Bureau of Standards.

Specifications for Iron and Steel to be Welded—Chairman, W. J. Beck, American Rolling Mill Company.

Sections of the American Welding Society are located as follows:

Buffalo, N. Y.	Cleveland, O.
Philadelphia, Pa.	San Francisco, Cal.
Chicago, Ill.	Los Angeles, Cal.
Pittsburgh, Pa.	Boston, Mass.
New York, N. Y.	Kansas City, Mo.
Schenectady, N. Y.	Detroit, Mich. (in process of formation)

It is the aim of the American Welding Society to correct some faults that are plainly discernible and that can be attributed to lack of co-ordination among the users and manufacturers of welding supplies and equipment respectively and also as between the users and manufacturers.

The welding industry is comparatively young and it has so many potential possibilities that it is necessary for the benefit of all concerned therein that ideas be exchanged, the good ones being accepted and put to use and the useless ones put to one side.

Welding is now recognized as one of the greatest aids in the construction and repair of metal structures and parts. The matter of fastening two pieces of metal together is one of the fundamental problems of mechanical engineering, since all machines and metal structures are made up of many pieces of metal fastened together. Time, labor and material may be economized in correctly designed welded structures.

It is also a function of the American Welding Society to distribute literature on welding matters to all members, and as soon as a permanent organization is effected, there will be pamphlets mailed out that will show in detail all steps taken regarding the furtherance of this Society from its inception, also monthly meetings to be held at which time papers will be read. In this connection there is a journal published each month that goes to each member and contains welding data that is very valuable to members of an organization of this nature.

Membership in the American Welding Society permits the use of the Society's emblem on stationery.

The American Welding Society has done considerable work in the matter of developing specifications for material and methods for correct welding, seven phases of which have already been published in pamphlet form, copies of which pamphlets are now in the hands of the temporary officers of the Detroit Section, and they may be purchased for a nominal sum which covers the cost of printing.

These bulletins are as follows:

Bulletin No. 1—Standards for Testing Welds.
Bulletin No. 2—Welding Wire Specifications and Folios.
Bulletin No. 3—Standards for Arc Welding Apparatus.
Bulletin No. 4—Training Course for Oxy-Acetylene Welders.
Bulletin No. 5—Welded Pressure Vessels.
Bulletin No. 6—Applications of Arc Welding to Ship Construction.
Bulletin No. 7—Training Course for Electric Arc Welders.

Further, the American Welding Society has in the works a study of welding rail joints and investigations in electric, gas and thermit welding.

These facts are mentioned to show the scope and magnitude of the work carried on by the American Welding Society and to show also the benefits accruing from membership in this Society.

The following shows the different classes of membership included in the American Welding Society and the costs pertaining to each:

Class A—Sustaining members, being individuals or individuals delegated by corporations, firms, partnerships, etc., interested in the science and art of welding, with full rights of membership.
Annual dues $100.00

Class B—Members, being individuals interested in the science and art of welding, with full rights of membership.
Engineers, or individuals competent by experience or training to plan or direct welding operations are eligible to this class.
Annual dues $20.00

Class C—Associate members with right to vote but not to hold office, except in Sections as may be provided for by the By-Laws of the Section. Supervising welders, inspectors and skilled operators, with three or more years' practical experience in welding are also eligible to this class.
Annual dues $10.00

Class D—Operating members, who are welders or cutters by occupation, without the right to vote or hold office in Sections as may be provided for by the By-Laws of the Section.
Annual dues $5.00

Application blanks may be procured from Mr. C. L. Finch, Temporary Secretary.

A general meeting will be called in September to formally organize a Detroit Section which will include all or the major share of the State of Michigan and you are cordially invited to be present at that time—the exact date will be announced later.

The Executive Committee will hold meetings during the summer months to consider ways and means of expediting the formation of a local section as well as to aid prospective members in any and every possible manner. The members of the Committee will gladly answer questions relating to this matter and will render any service within their power. Bulletins, supplementing this letter will doubtless be sent to you between now and the time the General Meeting is called.

Will you kindly detach, fill out and mail the slip provided at the bottom of this sheet.

(Signed) H. M. GOULD,
Department of Street Railways,
Shoemaker & St. Jean Aves., Detroit.
Temporary Chairman,

(Signed) C. L. FINCH,
Temporary Secretary & Treasurer,
Detroit Range Boiler & Steel Barrel Co.
2475 Twenty-fourth Street, Detroit.

ELEVEN MAXIMS FOR A WELDING SHOP

Smith's Inventions, Incorporated, of Minneapolis, Minn., have recently sent out the following maxims for a welding shop. Additional copies of these maxims may be had upon application to them.

1. Our favorite jobs are old grate bars, water backs and heavy heater sections. If you bring one of these jobs, you will be welcome.

2. Be sure and tell us what kind of metal your job is made of. We have no other way of finding out and depend on your knowledge altogether.

3. Never bother to strip a casting. We have wrenches and tools of all kinds and plenty of time to take out screws, petcocks, stud bolts, bearings, bushings, etc.

4. Watch out for sparks. If one drops down your neck, stand on your head and jiggle it out, but in any event, don't get excited.

5. Fool with the tank valves and regulators all you want. The welder will gladly put out his torch and let his job cool off while you find out exactly how they operate.

6. If you see a welder sweating over a nice hot job, walk right up and start an argument or suggest a better way to do it. He has plenty of time to talk and will be in good humor for suggestions.

7. If you want to watch a job being welded, borrow the welder's goggles; he only wears them for looks, anyway.

8. Roam around the shop all you wish. If you happen to pick up a hot casting, the best thing to do is to drop it as quickly as possible.

9. Don't bother to step over a hose. Walk right on it; the welder just loves to have his torch pop out.

10. If you smell acetylene, light a match and look for the leak. The shop will be rebuilt and the leak repaired by the time you are out of the hospital.

11. Ask questions and argue with the men all you want. They are paid by the hour and so have plenty of time for social chats and long discussions as to why their way of welding a job is always the best.

PROPOSED ELECTRIC WELDING STANDARDS

Proposed Standards for Electric Arc Welding Apparatus is the title of a comprehensive pamphlet issued by the American Institute of Electrical Engineers. The aim of the bulletin has been to define the terms and conditions which characterize the rating and behavior of electric apparatus with a special reference to the conditions of acceptance tests.

WELDED OFFICE FURNITURE

Welding Assures Long Life to Office Equipment—Reduces Weight—Gives Dust Proof Seams and Strong Construction

By A. C. FORMAN*

WITH sparks from a friction lighter the welding operator lights his oxy-acetylene blowpipe. He slips the amber goggles from his forehead down over his eyes. Then, under his steady hand, the glowing tongue of blue-white flame licks the two steel edges before him.

Almost instantly a small red spot appears. This grows into a pool of liquid metal; the steel edges flow together. And with a twist of the operator's wrist the flame is moved a bit along the joint.

As this is repeated the welder's movements become more and more rapid until the blowpipe is traveling in a continuous succession of swinging dips. Two pieces of metal are being welded —fused into a single piece—with the oxy-acetylene blowpipe.

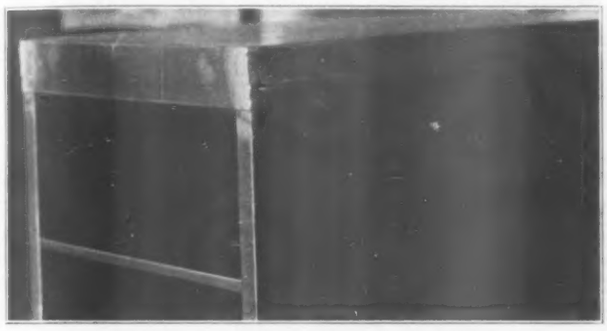


Fig. 1—Making a One Piece Joint

There is no joining method that is quite comparable with this process of welding metals, unless it be the sailor's method of splicing rope. But even this is not strictly parallel, for strands in the rope are only intertwined. Joining bricks and stone with mortar, wood with nails and screws, metal with bolts and rivets —in all these strength is dependent upon the joining material or its adhesion with the material being joined. Welded parts are not really joined; they are truly made into one part having the strength of a seamless piece of metal.

Experience with sheet steel office furniture, in both its manufacture and its use in the past show that the principal drawback in most types was an inefficient and unsightly joint between metal members. Lapped seams joined with rivets or small bolts form the point of greatest weakness and most frequent failure. Furthermore, these lapped joints required more metal, and consequently results in heavier, bulkier products.

Discovery of the point of weakness was but a step ahead of adopting means to correct it. It seemed elemental that to overcome the defects of riveted joints was simply a matter of eliminating the joint—that is to say, welding it. In fact, oxy-acetylene welding has proved to be the ideal method for use in the fabrication of steel office equipment. This process has made possible the manufacture of letter files, filing service safes, card index cases, plan files, desks, typewriter desks, office tables and many other items that give far more satisfactory service and are lighter and less bulky than could be built by any other means.

Welded corners and seams are strong and secure. They are proof against vibration and corrosion. Finished smooth by grinding with an emery wheel or by filing, they can be painted or enamelled so that it is impossible to tell the location of the weld.

Welds are just as strong as the original metal of which they are made. Steel office equipment, built by welding, is in fact seamless, it is of one piece of metal.

These advantages of welded construction would be of no avail unless they could be translated into terms of benefit to the user. The man who is buying filing cabinets is likely to care little what process of manufacture is employed unless it directly affects the quality of the material he buys or the length of satisfactory service he can reasonably expect to receive from it.

Fig. 2—The Welded Corner Before Filing and Enameling

As a matter of fact, welded construction in steel office equipment assures longer life to the user. Filing cabinets cannot warp out of shape. Stresses imposed by heavily leaded drawers, or by forcibly closing them will not cause the drawers to stick. Welded seams are dust-proof. Welded equipment is lighter than made by other means. And the finish that is possible over welded seams adds greatly to the beauty of welded steel furniture.

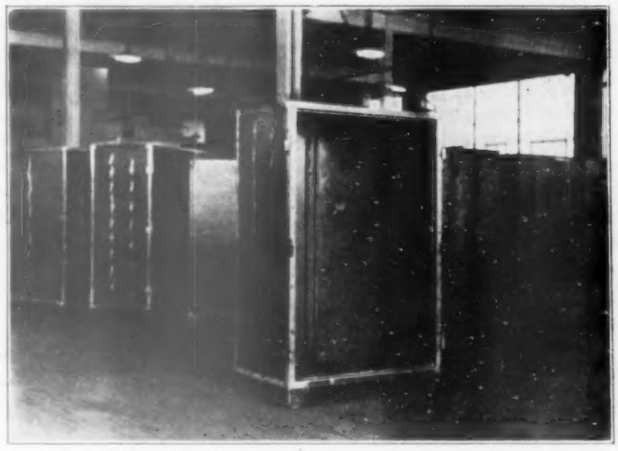


Fig. 3—Welding Makes Them lighter and Stronger

All of these things mean greater desirability, therefore longer life, and are resulting in a marked preference among users for steel office equipment built by oxy-acetylene welding.

*Van Dorn Iron Works, Cleveland, O.

ALL-STEEL AUTOMOBILE BODIES

Oxy-Acetylene, Electric and Other Processes Used—Many Advantages Claimed for All-Welded Bodies—Lightness, Strength and Smooth Finish

By J. W. MEADOWCROFT*

THE Edward G. Budd Manufacturing Company, Philadelphia, Pa., manufactures automobile bodies of all steel construction. This body is practically a one piece body, due to the tremendous amount of welds used. The size and construction of the various bodies produced for the many automobile companies plays a very important part in the amount of welding used, but the average amount on each body is as follows: 1,000 to 1,100 spot welds, 70" to 80" of gas welding, and 10" to 12" of metallic arc welding. By using these three methods of welding in accordance with the construction of the bodies, long life is added to each body, and vibration, squeaks and rattles are eliminated.

Special electric welding machines are designed and constructed under certain standards (governed by the method of welding used), so that all bodies are held to correct dimensions while being spot welded. In assembling and welding all-steel bodies in these specially built electric welding machines, considerable time is saved in handling and welding the parts, as they are so assembled that enough welds are placed in same in a short period of time to provide the strength required. This allows us to produce large quantities of bodies on a small number of machines. Regardless of the method of welding used in connection with the assembly in these machines, the highest efficiency is procured as no time is lost, because each operator does his particular part, finishing with his helper or helpers at a specified time period. Another feature of economy in production from these specially built welding machines is that the welding operators get the highest efficiency in assembling and welding the various parts of the bodies due to the fact that the stampings or parts are interchangeable. Many welding operations are done on conveyors regardless of the method, and although to the average engineer this seems impossible, it is done without any loss in the efficiency of the operation. Many other operations are done on the conveyors, but there is no interference with the various welding operations.

The acetylene welding operators are assigned to weld various sections of the body, and in each case the welder is a specialist on welding his particular part. This holds a standard in the acetylene welding method, and uniform welds are made on the various sections of the bodies. Many parts of the interior of the body are acetylene welded and this adds considerable strength to the bodies.

Metallic arc welding is also used on the interior of the bodies where no finish is required, and many parts are arc tacked together without the aid of clamps, jigs, etc., and the pieces are still kept in alignment. This method is also used on sections of the doors where a quick weld must be made to prevent warping or buckling of the various sheets of light gauge metal, eliminating a considrable amount of finishing.

In the design of the bodies, the utmost care and thought is taken to lay out the various sections of the bodies, and to arrange the stampings that are welded, in order to facilitate their ready assembly in the specially designed jigs and fixtures. The assembled bodies are light in weight, strong, free from defective joints and present an exterior surface which is free from all imperfections. Imperfections such as pits, blowholes, or indentions in the metal, seams, or joints, are absolutely avoided, as any one of the conditions in the metal would act as a reservoir for japan which, when applied and heated to 450°F. in baking ovens, would produce a blow or blister. The surface is kept free from any depressions or cavaties in which more than the standard thickness of enamel can flow.

Many of the stampings have different shapes, making it necessary to weld additional pieces to them, and all parts clamped together in such a manner as to assure good contact in making welds. This is essential in spot welding, as it is necessary to spot weld the various sections of the bodies together so that all indentations in the metal are eliminated. On some of the interior parts, which are not exposed, the indentations receive no consideration as no finishing is done on these parts, but in all cases where welding is used, whether it be interior or exterior, whether parts are perfectly flat or shaped, it is absolutely essential to make the proper allowance for contraction at the point of the weld, so that the bodies are produced in their proper shape and held to their proper dimensions. By making the proper allowance for contraction the bodies are held uniform. This makes it possible for fenders, and other accessories made correct to shape, to be interchangeable.

In the process of manufacture at the Budd Plant, more light sheet steel is used and more welding is done than in the manufacture of any other commodity made from sheet metal. All methods of welding—Thermit excepted—are used, and no matter what method is applied, it is applied from an economical as well as a productive standpoint. One day's production in the Budd Press Shop amounts to 600,000 strokes, and more difficult steel stampings are made here than in any one plant in the country. The steel consumed in one day's production amounts to approximately 1,000,000 lbs. In our daily production, 18,000,000 spot welds are made on 360 standard electric welding machines and 150 special machines. The daily shipment of Budd All-Steel Bodies amounts to 80 car-loads containing approximately 2,200 complete bodies assembled and 1,750 complete bodies unassembled.

The application of the various methods of welding would be of very little value from an economical standpoint if more finishing was needed due to them. In speaking of finish, we come to one of the most vital items given consideration in the Budd Company, as only three coats of paint are applied to bodies, making it necessary for the finishing to be of high class order, as imperfections of any kind would magnify many times after the final coat of enamel is baked on at 450°F. All-Steel bodies are painted in a time period of approximately one day whereas composite bodies are painted in a time period of from 14 to 21 days, and are given nine to fourteen coats of paint. A cheaper grade of metal can be used on composite bodies, due to the many coats of paint and filler which are used, but the lasting quality of the paint on all-steel bodies is far superior to that of composite jobs. The reason for this is, that composite bodies are made from wood and steel, which, of course, cannot have paint baked on at such a high degree of heat.

Another very important feature in favor of an all-steel body is its tremendous safety value. Although all the automobile manufacturers are not using Budd All-Steel Bodies, it is only a matter of time when all bodies will be all-steel welded construction, as bodies of this nature will dent or bend in collision, causing less serious results to both the occupants and the car. The car can be restraightened and used again, causing practically little or no loss to the owner. When a composite body is in a collision it telescopes, causing serious injury to the occupant, and practically a total loss to the owner of the car, as practically no material can be saved. There will be no doubt whatever in the public's mind regarding the value of this change of construction, because of its real value to humanity.—*Acetylene and Welding Journal.*

**Supervisor of Welding, E. G. Budd Manufacturing Company.*

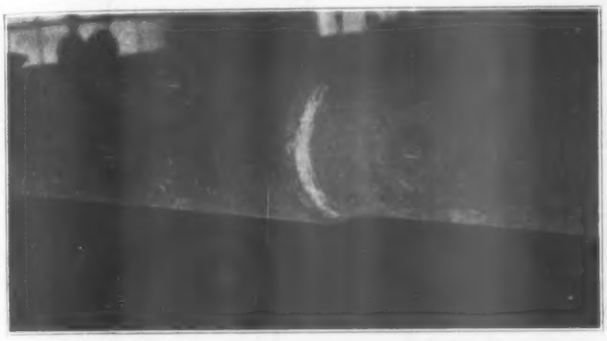
WELDED PIPING IN BUILDINGS

Oxy-Acetylene Welded Pipe Joint Selected for Strength, Durability, Lightness and Economy—Lack of Information Has Retarded This Application

By H. E. WETZELL*

THE applied science of pipe welding is comparatively old. But its field has recently been extended to the welding of piping systems in buildings. Almost simultaneously from different sections of the country have come reports of building piping installations made with the aid of the oxy-acetylene blowpipe. These indicate that rapid strides are being made with this development which is so vitally interesting to piping contractors because it effects their work, procedure and processes.

The oxy-acetylene process has been used for some years as an important and accepted means of fabricating piping in the shops



Welded Reducer

of individual companies and pipe lines in the field. That it has proved successful and economical in these applications predicates its advantages to the building industry. The men who specify welding for pipe lines and plant piping are usually the owners themselves, who, being free to choose their own methods select the oxy-acetylene welded pipe joint because of strength, durability, tightness and economy. But the men who propose oxy-acetylene welding of building piping are subject to the desires or specifications of the owner, architect or engineer of the building.

To this condition can probably be attributed the fact that the practice of welding building piping is only at this time getting into full swing. The authorities mentioned had to be convinced and they have been convinced. The passive interest heretofore shown by these authorities in the welded pipe joint was probably largely due to lack of complete information on the subject. One

Cast Fittings Are Eliminated

engineer, for instance, thought a branch was welded to a main line by cutting a hole in the main line large enough to permit entrance of the branch which was then welded in without knowing its amount of projection into and consequent obstruction of the main line. On the contrary, however, the branch is not inserted into the main line. The procedure in making a branch connection is to shape out the end of the branch pipe with a cutting blowpipe so that it will fit the contour of the main pipe. Then the branch is butted up to the main and the latter marked by chalking around the circumference of the branch. Next a hole is cut in the main line inside of the chalked circle but equal in diameter to the inside of the branch. Finally both the hole in the main line and the end of the branch are beveled, fitted and welded, giving the equivalent, so far as internal pipe friction goes, of a cast fitting. And such is the case with the whole story of welded piping—a little investigation will quickly uncover its advantages.

Heat Coils Are All Welded

The welded joint is stronger than any of the types of threaded joint. This is manifest when one considers that in threading a pipe its wall is appreciably cut into, thus reducing its tranverse strength, in some cases as low as 50 per cent. In the case of the welded joint, however, especially where the weld is built up, the strength at least equals, and in most cases exceeds, the strength of the pipe wall itself.

Installation time and expense are saved when piping is welded. Consider the advantages of taking standard lengths of pipe to the job, then merely putting them in position cutting and fitting them with the cutting blowpipe, then welding adjacent lengths together with the welding blowpipe. All thread cutting, leading, packing and caulking is avoided. Also, the use of the oxy-acetylene process for this work obviates the necessity of a very detailed piping layout and the necessity of using a specifically marked length for a certain location.

Welds Make These Bends and Connections Possible

The direction of run of the pipe line can be altered at will. It is merely necessary to cut butting ends to the desired angle with the cutting blowpipe then weld them together. Special fittings are unnecessary.

In fact, no fittings are necessary other than valves and those which can be readily fabricated on the job from the pipe itself.

(*Continued on page* 28)

*The Smith and Oby Co., Cleveland, Ohio.

Drilling Rego Welding Tips

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WELDED PIPE IN BUILDINGS

(*Continued from page 25*)

This fact also has a material effect on the cost in that the expense of the cast fittings are avoided. Furthermore, since the use of fittings is avoided the weight and hence the handling time and cost of the piping is materially decreased, especially in power installations.

The corrosion which usually takes place at threaded joints and the leakage at gaskets and threads of flange connections, is avoided when pipe joints are welded. The weld, when built up, makes the joint the thickest part of the pipe line and therefore the part which offers most resistance to corrosion. Hence, the life of an all welded pipe line is determined only by the life of the pipe itself.

Alteration of piping can be readily handled by means of the oxy-acetylene process. For example, take the case of adding a branch to a main line. The work required consists merely in cutting a hole in the main line with the cutting blowpipe, then welding the branch to the main line. Contrast this with the work required should the job be handled with screwed connections. A whole length of pipe would have to be removed, cut, and threaded, the branch connection threaded and the three resultant ends joined by a cast "T" connection. In other words, two joints to break, two cuts to make, three threads to cut and finally five joints to make. Again, summarizing the oxy-acetylene method of doing the job—two cuts to make and bevel and one joint to weld!

Another good feature of welded piping systems is their appearance. They present a smooth continuity of line unbroken by joints or fittings. And when it is necessary to cover such a line, the insulating jackets can be kept uniform. Large flange covers are obviated.

In all, the advantages of welding building piping is summed up in the following statements. Strength is increased. Close work and numerous branch connections are easily handled. The cost of thread cutting and fitting is done away with. The added weight of fittings are avoided, thus reducing handling costs. Corrosion which usually takes place at threaded joints is insured against as is also leakage at threads and gaskets. So it can be readily seen that the use of welded piping in buildings is both economical and practical.

ANNEALING SMALL CASTINGS WITH SAWDUST

By W. J. Field, Canada

For the benefit of your readers I suggest that the next time they are confronted with the problem of annealing castings, particularly small castings which have been welded and have to be machined, they will find that dry sawdust has many advantages over other materials, particularly lime or powdered asbestos. In the first place a small casting coming in contact with lime rapidly loses its heat by absorption on the part of the lime. On the other hand if the same casting was covered with sawdust the latter instead of absorbing heat would on catching fire start to create heat. Combustion would cease when sufficient sawdust was added to exclude the atmosphere.

In the case of small castings they should be thrown into a bucket kept half full of dry sawdust, then the bucket is completely filled with sawdust and as an extra precaution a cover can be placed on top. For large castings an excellent plan is to dig a hole in the ground having a good layer of sawdust and then after placing the red hot casting in the hole cover with sawdust and a final cover of earth. My experience is that a casting of whatever size remains hot much longer by this than any other means. Sawdust in most places is obtainable at very little cost and the charred sawdust adhering to surface of casting is easily removed which is not the case with lime or powdered asbestos, etc. I have recommended this wherever I have had the opportunity and the results obtained by those trying it have been very satisfactory.

X-RAY IN INDUSTRY

"X-Ray in Industry" is the heading of a short article in a recent issue of *The Iron Age*. It takes up the application of the X-Ray to coal analysis in England and the deeper penetration of steel. This comparatively new development concerning which much has been published in this country in the last year or two is being applied for the testing of metals and for the analysis of coal in Great Britain states *The Iron Age*. Dr. V. E. Pulling of the Research Department at Woolwich, England, delivered to the University College a lecture in which he said, "Previously investigators have not been able to see to a depth of more than ½ inch into iron and had been unable to detect faults smaller than ⅛ inch in diameter or width. It is now possible to see through 4 inches of steel and discover the smallest of flaws.

"An important factor at present, however, in radiography is the photographic emulsion. Radiation which penetrates 3 or 4 inches of steel passes too quickly through a thin emulsion of a plate. What is needed is emulsion of greater absorbent power. Penetration of a substantial thickness of a material like steel is dependent upon the electrical charge applied to the terminals of the X-Ray tube. Rectified alternating current is used at Woolwich for the production of the necessary pulsating direct current but the method is not satisfactory. If efficiency can be increased by securing a direct current of sufficiently high tension, penetration of 5 to 7 inches of steel will be possible." The great importance of X-Ray in industry, particularly the welding industry in the manufacture of cylinders and in determining the strength of welds, degree of penetration and their freedom from flaws is very evident. It is safe to suppose that even greater efficiency of the X-Ray in the steel industry will soon be developed.

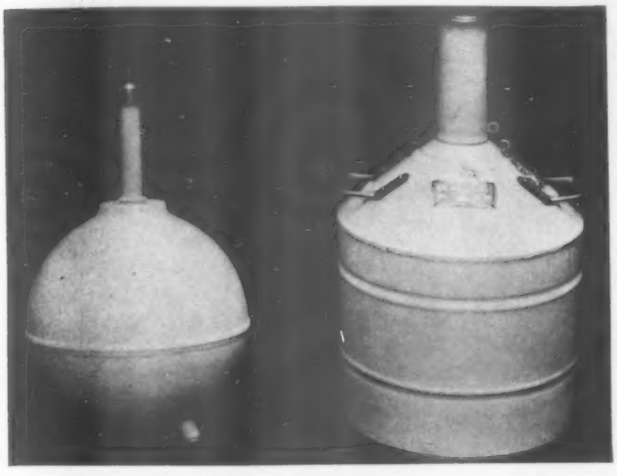
OXYGEN IN RUSSIA

On the subject of the production of oxygen in Russia, which is not being conducted on a healthy basis, a report says that in Leningrad there are five oxygen stations all working for local government requirements, whereas one of the factories alone would suffice. With the heavy overhead expenses, in maintaining the separate administrative bodies, and small load and continuous interruptions in the work of every station, the cost price of the oxygen comes out much too dear. In Leningrad the cost of oxygen is over 12s. per 100 cubic feet, whilst before the war it was about 5s. per 100 cubic feet. Whilst the oxygen station at Izhor is not working up to even 3 per cent of its 1916 production, the Leningrad Government Factory is ordering abroad an oxygen plant for itself. Besides this, the former Perun factory is being leased. It possesses an oxygen plant of great capacity in quite good order. At the Perun factory there is a carbide plant, the only one in Russia, which supplied the country with carbide previous to the war; but has not been running since 1917. The necessary carbide is imported from abroad, yet the production of carbide at the Perun factory could be quite easily arranged for. In Moscow, where there are four oxygen stations, the private owner of a small oxygen plant competes successfully with the Compressed Gas Trust and sells the oxygen at a very low price. In the Don basin, and generally in the Ukraine, the metallurgical and machinery works that use large quantities of oxygen for welding, get oxygen from Ekaterinoslav, and along with the delivery it costs over 36s. per 100 cubic feet. For the Karkoff and Lugansk locomotive factories oxygen is bought in Moscow and Odessa, costing 24s. per 100 cubic feet. Now there is a well-equiped oxygen station in Nikolaieff which could supply all these concerns with cheap oxygen. This is the neglected condition of the oxygen business, says an engineer correspondent of an official Russian journal, in other districts as well, particularly the South-East and Northern Caucasus—Acetylene and Welding Journal.

NEW PUROX PORTABLE CONTAINER

The Purox Portable Container is designed and built upon the principle that liquid hydrogen will create its own vacuum when placed in a double vessel. This is due to the fact that liquid hydrogen is so intensely cold that the air in the vacuum is immediately frozen. The frozen air is then deposited upon the sides of the inner bulb. The illustration shows at the left two concentric metal spheres, one within the other. Between these two metal spheres a vacuum is maintained. To the right is shown a view of the metal housing in which these two spheres are contained and which forms the complete container.

The application of the principles just outlined was not as simple as it sounds for it was found that heat reaches the contents of a metal container in the following seven different ways: (1) conduction through the residual gas in the vacuum space, (2) convection through the residual gas, (3) Radiation across the vacuum space, (4) conduction on the neck of



Purox Portable Container

the flask, (5) radiation through the neck opening, (6) conduction through the supporting materials, if any, crossing the vacuum space, (7) convection in the interior space of the flask and neck.

The general construction and design of the Purox Containers is similar to those made in England, Germany and France. The interior space is connected to the exterior space at the end of long neck tubes which are concentric. The spheres do not touch each other at any point. It is said that the low temperature greatly increases the strength of the metal and that the smallness of the neck prevents the inflow of heat. The various operations in the manufacture of this container necessitates great care and skill.

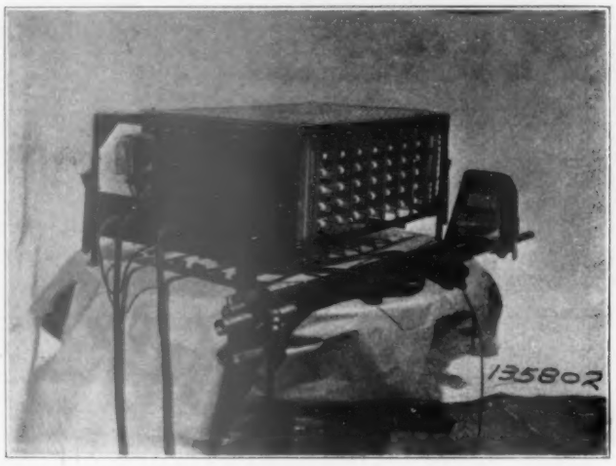
NEW WESTINGHOUSE ARC WELDING RHEOSTAT

The Westinghouse Electric and Manufacturing Company has recently developed a new arc welding rheostat which combines compactness, simplicity of design, low cost, and light weight. The overall dimensions are such that it can be taken on a street car platform, work car or in a small automobile. This apparatus is described in Leaflet 1757.

The rheostat is especially suited for mine and railroad service, for producing welds between rail sections, and cupped and battered rail ends can be built up. The welder is said to be suited for special work on cross overs, frogs, and switch points made of steels high in manganese or carbon.

When the rheostat is connected to any trolley line voltage between 400 and 650 volts, it will deliver from 60 to 210 amperes in 15 steps. If used in a cool place or outdoors in a breeze where plenty of ventilation is provided, it is claimed that the maximum rating can be exceeded considerably.

The control panel is mounted on the front, and is protected from the resistor units by a metallic heat shield. This panel contains a 250 ampere magnetic contactor which is remotely controlled by a foot master switch. The main welding current only passes through the contractor on the panel, and the foot switch enables the operator to open and close the contactor when chang-



New Westinghouse Arc Welding Rheostat

ing electrodes or for any other purpose. Four single pole knife switches are also mounted on the panel for obtaining the required variations of welding current.

The resistance element consists of a number of alloy resistors units supported horizontally and thoroughly insulated from the welded angle iron frame.

THE CHEMISTRY OF WELDING

One of the essentials of success in welding is that all impurities both in the material being welded and in the electrodes shall be removed from the vicinity of the weld, either floating upon the surface of a molten metal with the flux or else being consumed owing to the temperature at which the weld is made. It necessarily follows that a more or less accurate idea must be obtained of the nature of the material to be welded, so that steps may be taken to ensure that the impurities shall not prevent complete fusion at the two metallic surfaces. In a paper recently read before the Institution of Welding Engineers, Mr. J. B. Booer, taking as his subject "Some Chemical Aspects of Welding," discussed the various chemical changes which occur during the process of welding and the necessity for using electrodes which yield the correct flux for dissolving the impurities and preventing oxidization of the surface of the weld. He considered that it was the presence of inclusions of foreign material which was the chief cause of the failure of a welded joint. Chemical control, however, concerns more the preliminaries than the welding operation itself, and it is therefore essential for the welder to ascertain that all the materials he uses have been manufactured under efficient chemical control. This is particularly true for welding wire and also for the materials used in the preparation of fluxes for which the ihgredients should be absolutely pure. They should be perfectly mixed and the finished flux should be absolutely dry.—*Industrial Gases.*

ELECTRIC UNDER WATER CUTTING TORCH

The International Submarine Co., Inc., 95 Liberty St., New York City, have developed an electric torch which they claim is capable of cutting steel plate, steel piling or cast iron under water at any depth to which a diver can descend. Owing to the limited demand for such a torch, the manufacture of these torches for sale would be unprofitable, therefore, this company has perfected several outfits and have trained a number of divers to cut efficiently under water. At present the plan is to send these operators to do under-water cutting jobs throughout the United States.

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Economy

THERE are two kinds of economy—real economy and false economy. Maybe one should not say that there are two kinds, but false economy is so much in evidence all the time that it really should be given a place with true economy. True economy results in a very definite saving in time and money in the welding shop. For the economical shop is the one in which all of the apparatus is up to the minute and where labor and time-saving devices are the rule and not the exception. False economy results in indifferent work of poor quality, where the factors of speed and the workmen's conveneince and comfort have been entirely or almost entirely neglected.

Quick work is not always economical, although the quality of work done may seem to show that it is. Work must be so arranged that the welder can give all of his attention to the weld he is making. Working conditions must be right, the minimum of time and effort should be expended upon attending to the plant. Everything should be so arranged that there is no needless waste of gas and time, no needless wear on apparatus and equipment, no obsolete equipment to humor along to do a half way decent job where a new machine or piece of apparatus would do a nearly one hundred per cent efficient one. Skilled workmen, good working conditions, good apparatus and an efficient shop layout are the main features in securing economy in any welding shop.

Get Out The Vote

A FULL and free ballot is the safeguard of the republic. It is the duty of every citizen to get out and vote. This is in brief the text of a booklet, by the National Get Out the Vote Club, which is being broadcasted in an effort to bring out the Stay-at-Home Vote and the Absentee Voters. Nearly one-half of the voters of the United States fail to act as electors. The largest vote ever cast for President was in 1920, the total for all candidates being 26,713,832. Yet the astounding fact remains that for every 100 votes cast in 1920 there were 96 stay-at-homes or absentees, or a total of 25,705,063. The vastness of this large number of non-voters is quite appalling. If you were among the ranks of this non-voting army of 1920, it is up to you to do all in your power to convert this dormant army into a live, powerful and patriotic citizenship. Get out and vote and use your influence to get others to vote.

Good Business Ahead

ACCORDING to all of the professional business forecasters, there is good business ahead and plenty of it. Business conditions this autumn are much more favorable than they were last year, and according to all accounts there is every good reason to believe that during the next three months one will see a decided improvement in business, which will far exceed the normal seasonal improvement which is always expected at this time of the year. The various publishers of business forecasts, surveys and bulletins, all predict a moderate advance in the general level of commodity prices, reduced production and a somewhat freer buying policy. Well, let the good business come as fast and as much of it as possible, for we believe that the people who don't want good business are very much in the minority, if at all, so let's get on the jump and pick off all of the good business that is coming our way.

Welding Does Its Share

THE Round the World Flyers are once more on American soil after a noteworthy, history making flight. They made enviable history for our country, the aeroplane and welding, for welding played an important part in the making of their planes. Leakproof tanks and solid joints were fabricated by welding. The details of this work were set forth in the May issue of *The Welding Engineer*. As we welcome the Round the World Flyers and extend to them great praise for their courage, we must also extend great praise to the able designer and the competent welders who helped make this hazardous adventure successful.

ACETYLENE remains today the only practical welding gas and by far the best gas for cutting. This is in spite of continuous efforts to substitute other fuel gases. Most users realize that since acetylene is perfectly adapted for both welding and cutting, it is unnecessary to have two stocks of fuel gas and two types of apparatus for cutting and welding.

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WELDING LARGE STORAGE TANKS*

How Large Storage Tanks Are Electrically Welded—Advantages of Welded Tanks and Future Application of Welding in This Field

By HAROLD C. PRICE†

ONE year ago, that is in January, 1923 there had not been constructed a single oil-storage tank of 55,000-barrel or more capacity with a completely electric welded roof and bottom. Today there are at least fifty 80,000-barrel storage tanks completed, or nearing completion, on which both the roofs and the bottoms are electric welded. It is the purpose of this paper to describe, in a general way, the construction of these welded roofs and bottoms, and to give their advantages over riveted construction.

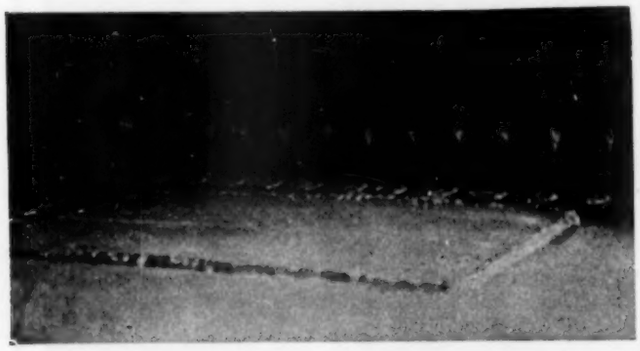

Fig. 1—Electric Welded Seams and Rivets of Bottom in 55,000 Barrel Tank, Showing Also Patch Plate Welded to Bottom

All of the following data and conclusions were obtained from observations made during the welding of tanks by the Welding Engineering Co. at Texas City, Tex., and Tonkawa and Burbank, Okla.

As far as can be determined, the first electric welding on large tankage was completed in May, 1922. At that time the Empire Companies of Bartlesville, Okla., discovered a badly leaking bottom in a 55,000-barrel tank at El Dorado, Kan. They had considered concreting this bottom, but because of the much smaller cost, decided to try electric welding; so a contract was given the Welding Engineering Co., of Bartlesville, Okla. In this instance, no new sheets were added, the bottom being repaired by electric welding of all seams and rivets, Fig. 1. In some places where the original rivets were missing, the holes were filled by welding; patch plates were also added at certain badly worn spots. This tank has since been in service over a year and a half, but no other leaks have been discovered. The cost of electric welding was about one-half that of a concrete bottom.

Fig. 2—Welding Angle Iron to Bottom

Shortly after this, the Cosden Company began to electric-weld the roof seams on the storage tanks at its refinery at Tulsa. These, however, were riveted roofs, the rivets being laid at a pitch of 4 in. The welding, therefore, on these roofs simply took the place of the caulking edge, and was not applied for strength. According to the officers of the company, welding has furnished a gas-tight roof.

The Standard Oil Co. did some similar work at Neodesha, Kan., during this period. In the latter part of 1922 one of the large tank-construction companies erected the first all-welded roof at Humboldt, Kan., but the real construction of both roofs and bottoms did not begin until February, 1923. At that time the Marland Refining Co. let a contract to the Welding Engineering Co. to repair three 55,000-barrel tanks at Texas City, Tex. All the seams and rivets in the bottoms of these tanks were to be welded, as were all the seams in the shell. The tanks to be repaired were hardly a year old, two of them had never been filled with oil, yet the rivets and seams were leaking badly. With the expense of these repairs in mind the Marland Refining Co. decided it would save considerable money if the bottoms and roofs of all tanks were welded during the original construction; therefore, contracts were awarded for nearly fifty tanks at Texas City, Tex.; Ponca City, Tonkawa and Burbank, Okla., with electric welded roofs and bottoms.

Fig. 3—Finishing Weld on Bottom as Shell is Being Completed

As there are no holes to be punched in the plates, the sheets for this work, with the exception of the sketch plates, are shipped direct from the mill to the job, without going through the shops. In most cases the sketch plates are cut in the shop; sometimes they are cut in the field by the use of an acetylene torch. The first method is the better and cheaper, for when the sketch plates are cut in the field there is considerable waste of material; also unless the film of oxide left by the acetylene is thoroughly removed from the plate there is likely to be considerable leakage through the weld. After the grade for the tank is made, the bottom sheets are laid directly upon it; no horses or scaffolding are necessary, as when the bottoms are riveted. All plates, both roof and bottom, are laid with a 1-in. lap. The bottom plates are first laid in position and tack-welded, after which the angle iron is placed in position, tack-welded, and then completely welded to the bottom, Fig. 2. After the angle iron has been completely welded to the bottom, the shell of the tank is raised and riveted, while the welding of the bottom sheets is being completed. The shell of the tank is riveted and the structural steel for the roof is erected in the usual manner, Fig. 3.

The roof plates are then raised, by the means of a cam or screw clamp, and laid, in the usual manner, from the edge toward the

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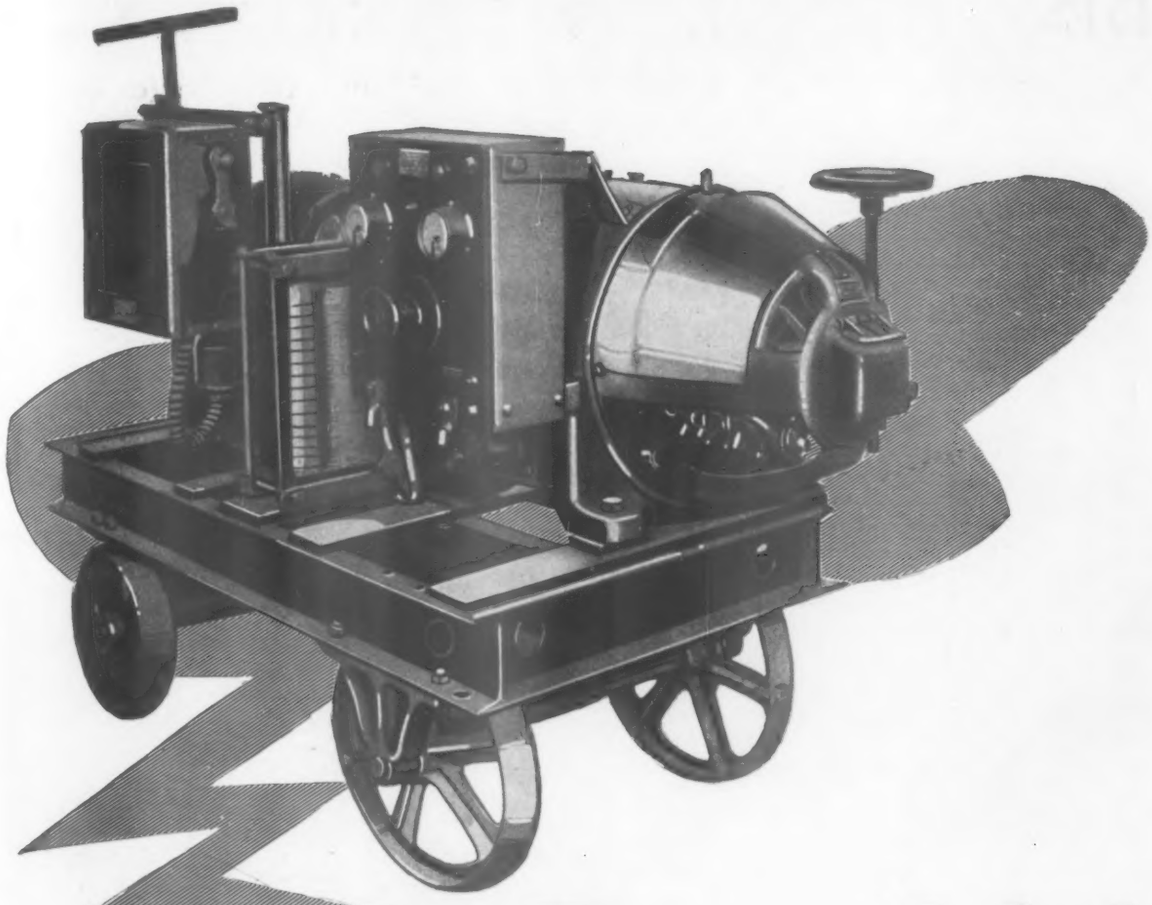
†*Manager, Welding Engineering Co., of Bartlesville, Okla.*



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center. They are tacked to the top angle and to each other as they are laid, Figs. 4 and 5. The first method was to tack the plates on the ends and in the center, in order to expedite the laying; a second welder would then permanently tack with a 12-in. spacing, Fig. 6. But by this method, because of buckling between the temporary tacks, it was often necessary to use weights or leverage to bring the plates in contact with each other. Later, two welders tacked simultaneously on each plate, working in one direction only; this eliminated the buckles and the necessity of further tacking. After the plates were tacked, other welders laid the permanent weld. On the bottoms a weld the full thickness of the plates was used; but on the roofs a weld of 1/16 in. less than the thickness of the plates is sufficient; in other words, on 3/16-in. plates a ⅛-in. weld is sufficient.

Fig. 4—Tacking First Course of Roof

A rigid inspection is given all work at the end of each day; anything looking like a pinhole is marked and rewelded. The bottoms are tested by pumping oil under the tank through fourteen flanges welded onto the bottom. On the second bottom welded at Texas City, only two pinholes developed, despite the fact that the bottom had been laid in very wet weather under the most difficult conditions; on the third bottom, only five pin-holes developed.

The results on the first bottom showed well what not to do. In this case oil was run on the grade inside of the curbing before the plates were laid. Sloping horses, as shown in Fig. 7, were then placed across the center of the grade, and the plates dragged upon them, the intention being to weld two courses of sheets, drag the horses out part way, lay two more courses, weld those, and repeat the operation. Two difficulties presented themselves: First, it seemed impossible to lay the sheets without getting them fairly covered with oil; this, of course, made good welding quite difficult. Then, after, the horses had been pulled out and the sheets rested on the oil, the hot sun would tend to buckle the plates considerably; in addition, there was always the danger of fire, in fact one small fire did occur. Nevertheless, this bottom was finished by this method. It showed a great many buckles and developed about 100 pinholes; these were re-welded and when the tank was finally completed and tested, it showed no leaks.

Fig. 5 — Tack Welding First Plate to Angle Iron on 55,000 Barrel Storage Tank.

The tests made by the Marland Refining Co. on the roofs at Tonkawa showed excellent results. Strips cut from the roofs through the weld transversely to the welded seam had an average tensile strength of 40,000 lb. per sq. in.; in other words, the weld was 72½ per cent the strength of the plate, using 55,000 lb. as the tensile strength of the plate. As the strength of the joint of a single riveted roof, using 3/16-in. plates and 7/16-in. rivets, is only 40.1 per cent efficient, the fear of weakness in a welded roof is completely dispelled. A photomicrograph of the cross-section of one of these test pieces is shown in Fig. 8.

Three bottoms and sixteen roofs were electric-welded during 1923, under the observation of the writer, Fig. 9. All of these tanks have been subjected to extreme changes in temperature, and to date there has not been a single evidence of failure. No cracks have developed and, consequently, no leaks. We do not mean that there have been no pinholes; there have been a few, and these were easily rewelded or calked. The welding of these tanks was done in the worst kind of weather. The heavy rains in Texas and Oklahoma have given the practicability of the work a test not contemplated when the work was started. Good welding cannot be performed on a wet surface; rains therefore delayed the work. At times, also, in Texas the dew was so heavy at night that work had to cease until the sun came up. Strong winds also caused trouble. One obstacle for which we were not prepared was the attraction of bugs to the arc. Fortunately this would occur only on a very warm, breezeless night, but when it did the speed of welding was greatly reduced or welding ceased altogether, for the multitude of dead insects not only obstructed the weld, but proved very disagreeable to the welder.

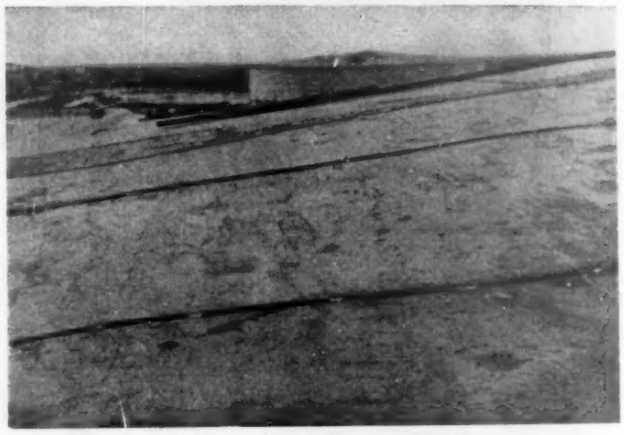
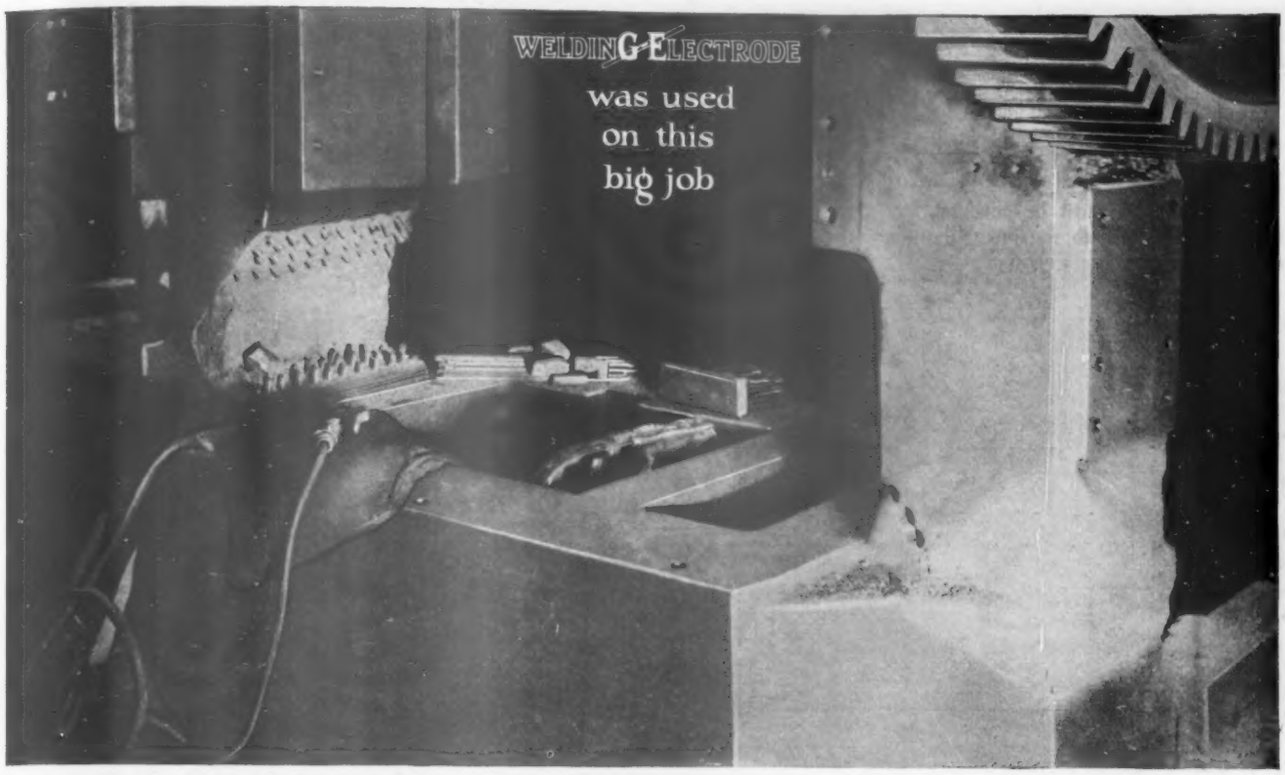


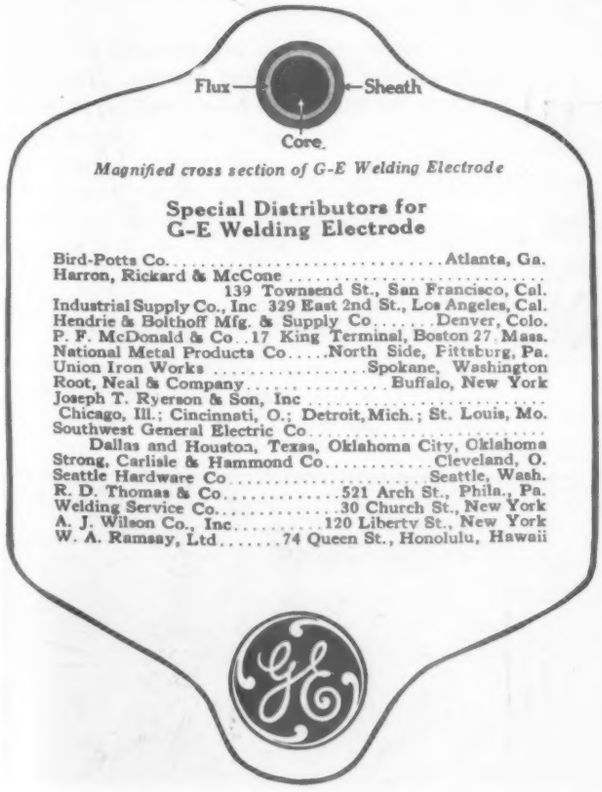
Fig. 6—Roof Plates Tack Welded, Ready for Final Welding

Records kept of all welding operations on the nineteen roofs and bottoms disclose the following average welding speeds: Roofs, 16 ft. per hour; bottoms, 14 ft. per hour; bottom angle to bottom plates, 4½ ft. per hour; tacking 70 hours per roof or bottom.

Roof and bottom plates were of 3/16-in. steel, except the bottom sketch plates, which were ¼ in. Bottom angles were ⅝ in. thick and were welded to a height of at least ⅜ in. As stated, these figures are averages of all the welders; some men worked faster than others. At times under perfect conditions, speeds of 20, 25, and even 30 ft. per hour were made. On an 80,000-barrel tank, there are approximately 2,900 ft. of roof seam, provided 6 by 18 ft. plates are used; this size plate is readily handled. Should a smaller sheet be used there would be more footage, and the cost of the welded roof or bottom would naturally increase.

Both electric-driven and gasoline-driven welding machines of the direct-current type, with short arc characteristics were used on this work. On the gasoline-driven machine, two shifts were used, working 18 to 20 hours a day. On the electric-driven machines, three shifts were used, working 22½ hours a day. We found the short arc of great advantage in assuring high-grade welding. It was necessary, of course, to use only the best welders. Many men who applied for work had been using long-arc machines. Some of these, the poorer welders, were unable to operate with a short arc even after being given considerable time to practice; the better welders, however, found no trouble in oper-





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ating with the short arc after working two or three hours. Because of this we were never in fear of having poor welders on the job.

Several kinds of welding rods were tried, but we found that a coated rod of 5/32 in. diameter gave the best and most uniform results and warranted the small additional expense.

The advantages of the electric-welded roof and bottom are:

1. As no holes must be punched, the plates can be shipped direct from the mill to the job without going through the shop for fabrication.

Fig. 7—Bottom Laid on a Crude Oil Foundation, Using Sloping Horses

2. The bottom can be welded directly on the grade, thus eliminating the expense and time of placing the plates upon horses; the usual working of the rivets and calking edges in the bottom, as it is being lowered, is also eliminated.

3. Sheets are much more readily fitted in place as there are no rivet holes to be matched.

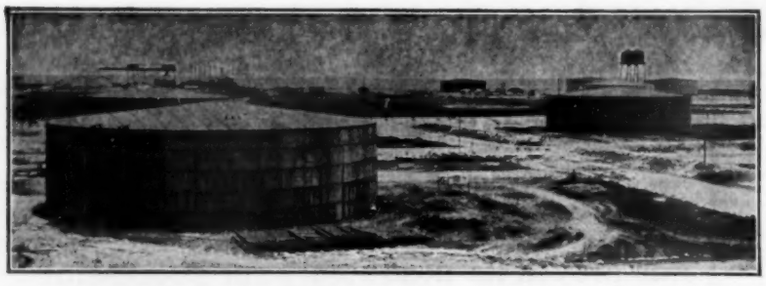

Fig.9—New Electric Welded Roofs on Old 55's, Texas City, Texas.
Fig. 10—Riveted Roof

4. The shell can be raised while the bottom is being welded saving time in construction.

5. The one-piece roof expands and contracts uniformly with the change of the temperature, thus working of the rivets and calking edge as on a riveted roof is eliminated. This makes the roof absolutely gas-tight and greatly reduces the fire hazard; the cost of insurance should be correspondingly reduced.

6. The roof and bottom are smoother than by riveted construction, eliminating strains caused by buckling, Figs. 10, 11 and 12.

7. A welded joint should have longer life than a riveted joint; in nearly all worn-out bottoms, the rivets have been the first to go.

8. The welded bottoms, being one piece, are absolutely tight.

9. The cost of scaffolding under the roof for the use of riveters is eliminated; with a welded roof it is unnecessary to have any one underneath, which is a great advantage in hot weather.

Naturally, the next step to be taken in tank welding will be the welding of the shell. One can expect to hear any time of this being attempted. The greatest difficulty in the welding of a shell will be in the assembling and tacking. A shell with the vertical seams welded inside and out should certainly develop a greater strength than one of riveted construction.

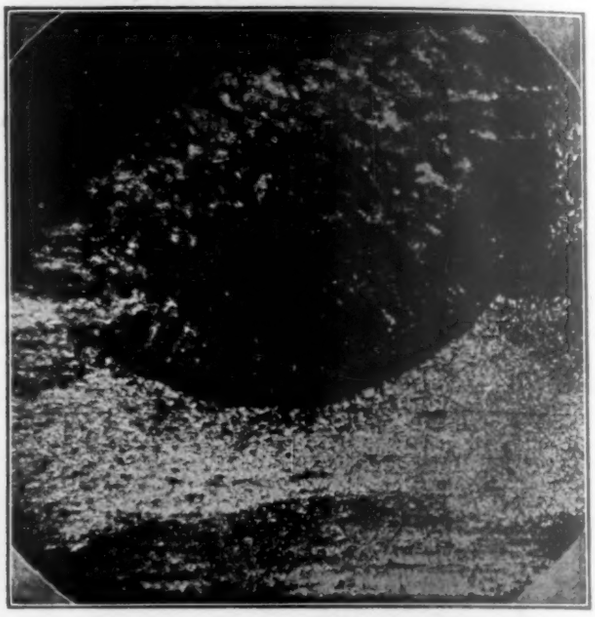

Fig. 8—Crossed Section of Welded Roof Joint Showing Penetration of Welding Metal Into Roof Plate

Another use for electric welding in tank construction is in the replacement of worn-out bottoms. Heretofore, where the bottom has been completely worn out, it has been necessary to build a concrete bottom or, if a steel bottom is desired, to tear down the tank, put in a new bottom and reconstruct it. By the use of electric welding, the tank can be cleaned, a sheet cut out of the first ring, new plates dragged inside of the tank, set in place and welded. The sketch plates can be welded on top of the bottom leg of the angle iron.

The writer wishes to acknowledge the assistance of V. T. Moon, chief engineer of the Marland Refining Co., from whom was obtained data relative to the tests made on the welded roofs; also the assistance and co-operation of the engineers and executives of the Chicago Bridge & Iron Works and the Graver Corporation in the developing of methods for the assembling of roofs and bottoms.

Fig. 10—Riveted Roof

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E. P. Jessop, New York, N. Y.—The Navy Department has been prevailed upon to put into its specifications the authorization to weld tanks completely. The 150,000-barrel tanks recently erected in Portsmouth, N. H., have electric-welded roofs and bottoms; they did not weld the circumference.

It must be remembered that welding today is not the unreliable thing it was a few years ago. When properly applied the average welder using proper equipment and method, will average 90 per cent strength in a joint, as against about 72 per cent for treble riveted, 64 per cent for double riveted and from 30 to 40 per cent single riveted. The strength is controlled by the ductility much more than by the tensile strength. You can get tensile strength easily, but ductility is a measure of the ability of the equipment used and of the operator to handle the metal; in other words, it is a metallurgical condition. It is possible almost to destroy the material and still get almost full tensile strength on a test, but the metal is crystal hard and will stand no vibration or buckling and would be practically useless in the oil industry. With the short arc, as described by the author, you get a ductile metal and, at the same time, full strength. He used only a ⅛-in. weld on his roof and yet had plenty of strength; no matter how much additional metal he would have added, he would have gotten little more strength because welding at the joint fuses the two pieces together and the greater part of the strength comes through this rather than through the amount of welding material added to the outside. The waste of welding wire is great because people believe that the more metal is put on a joint the stronger is the joint. If laid in with the proper method sufficient welding metal is about half the fillet on a double-welded joint. But even less than that may be used and still decrease the strength very slightly, as the two plates are fused together by the arc in addition to having the welded material there.

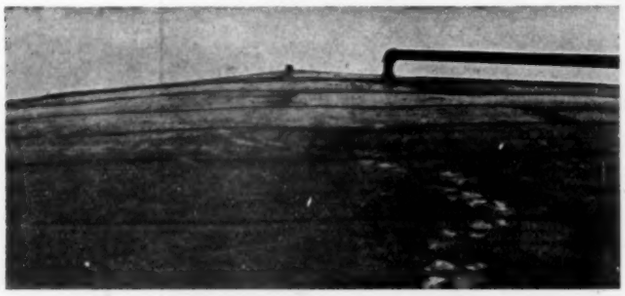

Fig. 11—Welded Roof Next to Roof Shown in Fig. 10. Both Photographs Taken Same Time and Place

But the point is that if a welded joint is two-thirds stronger than a riveted joint, or one-third stronger, as the thickness of the metal in the tank is determined by the fact that the single-riveted joint is only 50 or 60 per cent efficient, usually nearer 50 than 60, it is possible to save 25 per cent of the material on an all-welded tank and get a stronger tank and one that is gas-tight. So that welding, in the oil industry, gives three things: Lighter tanks, if you want them; gas-tight tanks, and tanks that require practically no upkeep. These three things make welding the natural method of assembling tanks that are assembled for permanence and not for just over night.

H. A. Wheeler, St. Louis, Mo.—How about the cost?

E. P. Jessop.—The cost is very nearly the same as the riveted cost. At Portsmouth I think the contract price was $70,000; we estimated that between $700 and $1,000 would have been saved if the entire tank had been welded. But original cost is a lot less important than it seems to be. A welded tank is a so much better tank that it will save you money in the long run; it is gas-tight.

H. A. Wheeler.—You do not rivet the vertical shapes?

E. P. Jessop.—I would weld the whole thing, but I would not let an unskilled man do it. It is possible to get 100 per cent strength in a welded joint, but the average joint will run probably between 85 and 90.

H. A. Wheeler.—How about burning the riveting steel?

E. P. Jessop.—The equipment enters into that. Burned steel becomes evident right away to any engineer that is on the job. They burned some plates on the tanks in Portsmouth but the fact was so apparent that a novice could see it. Visual inspection will tell you that. People say it is not possible to test a welded joint; you can test it the same way as a riveted joint.

Fig. 12—Welded Bottom Showing Smooth Condition of Plates After Welding.

The reason I am so sure of what I say is that in 1917 we did $273,000 worth of welding on the German ships in the Port of New York and not one of those welds has gone bad. They are all electric-arc welded. But any company that is planning to do this work on a big scale should have in its employ some one who knows welding; you cannot do it carelessly.

H. A. Wheeler.—Is the welding metal a high-carbon steel?

E. P. Jessop.—Its composition depends on the kind of work you are doing. The metal in this work would be a steel that would run strong in manganese so that, after going through the arc it would still have sufficient manganese to give it the proper toughness. It is also high in carbon.

FALL MEETING OF AMERICAN WELDING SOCIETY

The fall meeting of the American Welding Society will be held in Cleveland, Ohio, on Thursday and Friday, October 30th and 31st. These days have been chosen because they will not conflict with any other conventions of importance, and the chairman of the Cleveland Section of the American Welding Society has been assured of ample hotel accommodations by the mangement of the Winton, which he suggests be made the headquarters. Further developments and more definite plans will be published at a later date when things have actually been decided upon.

AUTUMN PLANS OF THE INSTITUTION OF WELDING ENGINEERS

The Institution of Welding Engineers is now engaged in drawing up this program for the autumn session. The Papers Committee has promised to have sufficient papers to hold the Institution each month from October to April. The promised papers cover the entire industry—electric, thermit and gas welding, oxygen cutting, acetylene generators, accessories, welding rods, etc. The plan now is to read at least one paper in the provinces.

TRACKS AND TORCHES

Railroads Find Cutting and Welding Profitable in Repairs on Tracks, Switch Points and Frogs

PROBABLY in no field has the use of welding become more extensively appreciated than in railroad construction. The great railway companies of the country were among the first to recognize the importance and value of welding as a fabricating possibility, and for their employment and fostering of a process which until comparatively recently has been shrouded with mystery due to lack of research and information, and which has long been treated with indifference and reluctance, they have been rewarded by a tremendous saving in time, labor, expense, and durability.

Welding in all forms—electric arc, oxy-acetylene, and thermit—now plays an important part in the numerous phases of railroad construction, and the associated process of metal cutting is an equally vital factor in repair and reclamation work.

The subject having been treated scores of times in the past, and always the same conclusion arrived at, it hardly seems necessary to go into the matter of comparing fabrication of steel by welding and by riveting—of pointing out the saving resulting from welding parts which, if riveted, would necessitate the labor and expense of cutting thousands of holes requiring the most minute exactness and accurate alignment. Nor does it seem necessary to go into a discussion of the desirability of a welded joint, which possesses a strength as great as either of the parts joined, over one which is riveted or bolted, the tensile strength of which is considerably less than either original section.

It is sufficient here to draw attention to the fact that railroad bridges are now constructed under methods in which welding has reduced riveting to a minimum. The steel girders are now joined autogenously, making for greater speed in construction and durability of service. Locomotives are now equipped with welded boilers. The frames of these locomotives are welded. Add to these and numerous other operations in railroad construction, the many services performed by welding and cutting in the field of repair, and some idea may be obtained of the extent to which these processes are now employed by the railway companies. It has been estimated that a saving of twenty-five per cent has been realized in the majority of fabrication of steel by welding over that by riveting and bolting, but in repair work this saving is stupendously greater. This has been particularly true in the case of salvaging of castings. Minor defects, such as blowholes, which formerly rendered a casting useless, can now be remedied by welding to the extent of making the casting completely serviceable, at an obviously appreciable saving.

Not the least important in the matter of repair work on railroads is that of track reclamation by welding. D. B. Allen, Reclamation Inspector of the Union Pacific Railroad, in an article in *Railway Purchases and Stores*, June, 1924, gives out the statement that in the year 1923 the Union Pacific repaired and built up by autogenous welding 895 frogs and 286 switch points, with a saving of about $57,000. This amount was realized in one year by just one company, and when it is remembered that all the other railroads are engaging in this method of reclaiming old points and frogs it can be readily seen that the total saving on all roads is anything but a trivial item.

Using the Torch for Welding Frogs and Cutting Bolts on Angle Bars.

The accompanying photographs show some of the track reclamation work being conducted in the Chicago yards of the Pennsylvania Railroad. Switch points which have been battered, worn, and scaled into the condition of those shown in the illustrations are built up with oxy-acetylene and a welding rod of No. 2 steel. The reconditioning of switch points constitutes a more difficult job than building up frogs, since the metal must be puddled and shaped on an incline almost vertical, an angle much more difficult to maintain with the torch and rod than one which is nearly horizontal, as is the case with most of the work on the frogs.

The welder is shown at work on these frogs in one of the photos. The job here is one of building up the two wing rails and the two points of the frog to the same horizontal level. The wear of the locomotive wheels on a frog has the effect of sloping off the inner part of the wing rails sometimes as much as twenty-five degrees from horizontal, and of beating down the points far below the original level of the frog. One photo shows a frog which has been built up, and beside it one which is in need of repair.

It frequently happens that one or both of the wing rails is so badly worn that welding it back to its original proportions would require more time and labor than would warrant doing the job. In such instances the old part is removed, a new piece of rail is taken, bent in the proper angle, and attached to the frog being repaired. The holes in the angle plate and rail may be cut with the torch, although it is recommended that this be done by machine, and with the proper sloping the new rail is made a part of the repaired frog.

The average length of time required for building up one of these frogs is from six to eight hours. The wing rails take about two hours each, and the two points—large and small—aggregate from four to six hours work. The cost of one of these hundred-pound frogs new is close to $100. The average cost of welding and building up an old one is about $18.00. New switch points cost about $50.00. Old ones can be built up and put in serviceable condition at an average cost of not more than $5.00.

Track and Bridge Repair. At the Left is Shown a Worn Frog (B), and One Built Up By Welding (A). A Collection of Battered Switch Points is Shown in the Circle.

Reclamation work of any sort must be something more scientific than an indiscriminate gathering and reconditioning of all junk. Attempting to work over all old parts to the extent of rendering them serviceable would prove in most cases more expensive than procuring new parts. It is necessary to determine whether or not the work which is to be repaired will, when finished, give the desired service, and whether the cost of making such repairs will permit a saving over the cost of a new article. Only where such a saving and satisfactory service are to be secured is reclamation profitable. Elsewhere the purchase of new parts is advisable.

This holds true in the case of track reclamation. Whole rails are not reclaimed by welding because the time and expense required would be too great. It has been found more economical to purchase and install new rails where needed. But in the case of frogs and switch points the amount of labor and material required for reconditioning is very small compared to the saving which is realized, and in view of the excellent condition and serviceability secured the operation is highly profitable.

There was a time—and not very long ago—when switch points and frogs which had been worn and scaled like those shown in the photographs were total losses as far as use was concerned. After a fraction of a point had been battered off or a wing rail of a frog worn down they were no longer safe, and the best that could be realized on them was the small price at which they were sold for junk or mill steel. Since the introduction and extensive use of fusion welding processes, however, these articles may be saved from an early condemnation and rendered useful for a long term of life.

Recently the Pennsylvania company conducted another bit of repair work in which metal cutting played an important part. The lift bridge over the south branch of the Chicago River was in need of newer and larger ties. The bridge is 280 feet long, has a double track with guard rails. Removing the rails to allow the laying of the new ties entailed cutting the bolts on the angle plates of eight sets of rails, cutting and fitting several lengths of rail at the junctions of the bridge tracks and the main tracks, and cutting several lock plates on the bridge.

One man with a gas torch kept a crew of thirty-eight men—carriers, layers, etc.—constantly busy, and in fact was able to keep far ahead of the actual laying job. Thus, the matter of rail cutting and removing, which under the old systems comprised a great part of such work and required a large sized gang in itself, was handled by one man, and was made a matter of lesser concern and attention to the engineers and superintendents of the work.

The operator had his gas and oxygen cylinders on a small push car which he shoved along in advance of his work. The illustrations show this work in progress and close views of the bolts on angle bars being cut.

The entire job was completed in four days, which by virtue of torch cutting, is far less than the length of time such a job would take where the cutting of bolts and bars was done with chisel and sledge. Moreover, the rapidity with which this job was completed obviated any great rearrangement of train schedules.

A GREAT CLEARING HOUSE OF NEW INFORMATION

The National Exposition of Power and Mechanical Engineering is now well established as the great annual clearing house of information concerning new developments in appliance for the generation and utilization of power. The Third Annual Exposition will be held in the Grand Central Palace, New York, December 1st through 6th, 1924, and will parallel the Annual Meetings of The American Society of Mechanical Engineers and the American Society of Refrigerating Engineers.

In a country depending upon power for its strength and growth it is only natural that a Power Show should flourish. Since man changed from a tool-using to a tool-controlling animal his demand has been for power and increasingly more power. The industrial supremacy of America is traced by many engineers to the fact that there is more installed horsepower per workman in this country than in any other country. Furthermore, the relation between the wage rate of one country to the wage rate of another is the same as the ratio of available horsepower in the two countries. The American workman is paid twice as much as the British workman because he directs twice the horsepower. In a time when the power demands of our metropolitan centers are doubling every ten years, when a power station built six months ago is out of date today, when all power engineers are straining every effort to seek out most economical methods of burning fuel and of generating and using power, an exhibition like the Power Show fills an important place in our scheme of existence.

The facts that at the present time the coming Show has twice the requests for space that the previous Show had at a corresponding time last year, that the attendance last year increased thirty per cent over that of the year before and that engineers and manufacturers all over the country are now making their plans to be present at the coming event, are definite proofs that its success is assured.

The importance of power in the development and maintenance of our civilization is not generally understood. It is true that the popular magazines and the daily press speak frequently of

it, but the diversity and complexity of the problems involved in power development and utilization can only be thoroughly appreciated after a visit to an exhibition such as can be found at the Grand Central Palace the first week of December.

The Power Show is looked upon as the great opportunity for comparing competitive products, for permitting actual contact with new appliances and the organizations that supply them, and as a place where buyers may receive expert advice from many manufacturing concerns in regard to money-saving equipment. The constant struggle for improvement furnished the necessary stimulus to commerce and industry, and an exposition which reveals new ideas, their uses and limitations is an important help in the struggle.

The managers of the Exposition are Fred W. Payne and Charles F. Roth, whose headquarters are in the Grand Central Palace, New York, N. Y.

OXY-ACETYLENE CUTTING APPARATUS FOR EMERGENCY

By T. C. Fetherston*

Early in July, newspapers in the East gave a considerable amount of space to a collision in Long Island Sound between the passenger steamer "Boston" and an oil tank steamer, which resulted in the loss of life of several persons on the former vessel. The victims of this accident were crushed in the steel wreckage of their staterooms.

Commenting editorially on this accident, The New York World in its issue of Monday, July 28th, has the following to say:

"In safeguarding humanity we are disposed to wait until a disaster takes heavy toll of life. The accident to the "Boston" was bad, enough, but it might have been so much worse that the first feeling was of relief. The better way would be to reckon on what might have happened and proceed accordingly.

"****Examination of the wreckage was impossible until the vessel had been towed to port. If scores had been trapped behind steel bulkheads and had been drowned or burned while rescuers watched, helpless for lack of cutting tools, the demand that such emergency apparatus be carried on all ships would have been instant. Why not heed the lesson as emphasized by the loss of four lives? Why wait until 40 or 400 lives are lost?

"Scientific use of steel bulkheads was supposed to have made passenger-ships practically unsinkable. The loss of the Titanic was an unanswerable warning. But does not the Boston accident prove the need for the oxy-acetylene cutting apparatus?"

The necessity for carrying tools and equipment for use in emergency on vessels as well as on railroad trains has always been recognized. In the days of wooden boats and wooden coaches, regulations prescribed that axes, saws and sledges be carried where they could be quickly reached in times of stress.

Now that most passenger vessels as well as up-to-date railroad equipment are steel, these tools, while they are still carried in most instances, are relatively useless in cases of accident.

An emergency always requires prompt action. To make any headway against steel plate and other types of steel construction with an axe or sledge is difficult, if not altogether impossible. But the development of oxy-acetylene cutting offers to ship owners and operators and railway officials a solution of this emergency problem. An oxy-acetylene unit, consisting of a cutting blowpipe, the necessary regulators and a cylinder each of oxygen and acetylene, would take up very little room on board any fair-sized passenger vessel. Mounted on a hand truck, this unit is readily portable and can be quickly moved wherever it is required. The blowpipe itself weighs but a few ounces and, fitted to long lengths of hose, it can be operated wherever a man can reach, and in any position. It will cut through the heaviest steel members found in the construction of vessels in a few seconds.

Oxy-acetylene cutting equipment is very easy to operate. It does not require any particular training and in a few minutes any member of the vessel's crew could be instructed in its adjustment and use. Such apparatus could, of course, be installed under the supervision of a machinist, a boilermaker, the chief mechanic or even the chief engineer. These men would no doubt require little instruction to enable them to operate the blowpipe successfully and to instruct the men under them in its handling.

This is a matter that well merits the attention of ship operators and owners. As the editorial writer in The World states, if a number of people had been trapped behind steel members in this recent accident, the demands that ships carry such equipment for emergency use would have been instant. A wise operating man will not delay the adoption of modern appliances until a shocking disaster brings the necessity to his attention, but will immediately see the advantage of preparing against more serious accidents.

Linde Air Products Company.

EFFICIENT RISER CUTTING

Illustrating Service Given in Special Cases Where the Need Was Not Known to the User But Was Pointed Out to Him.

It is one thing to do a job and another to do it efficiently. Sometimes it may appear that we have attained economy concurrent with efficient practice until some one comes along and does the same job a little better and at much less cost. Hence, it is advisable to investigate our methods periodically, or if in doubt as to their economy, seek the advice of some experienced person. Sometimes this advice comes unsolicited.

An oxy-acetylene service operator in making a recent round of service calls stopped at a steel foundry. This plant pours castings ranging in weight from ½ lb. to 1,000 lb. with risers varying from a fraction of an inch to 5 in. in thickness. All risers up to 1 in. thickness are broken off with sledge and chisel if they are so located that the casting will not be harmed by this method; otherwise, they are removed by means of the oxy-acetylene cutting blowpipe. All risers above 1 in. thickness, however, are cut with the blowpipe.

At the time of the service operator's visit, the castings were not segregated according to riser sizes preparatory to this cutting. They were merely laid in piles on the cleaning room floor. As a result of this practice the operators were compelled to do a lot of extra maneuvering in order to get castings in the proper position for cutting, and were thereby seriously delayed in their work. Furthermore, they were using the same size tip and pressure for all risers, regardless of size, thus wasting a considerable amount of oxygen.

The service operator's experience enabled him to recognize the insufficiency. He pointed it out and explained how to handle the work more efficiently and economically, recommending first, that the castings be grouped in the cleaning room according to riser sizes; second, that they be placed on the floor in such a position that the cutters could conveniently get at them; third, that the sand be brushed off with a wire brush, prior to cutting the risers; and fourth, that an operator, so far as possible, cut all rises of one size before passing on to others, and that he select the correct cutting tip size and oxygen pressure to use on each group of castings.

These recommendations were tried out and records of the amount of steel cut and oxygen consumed were kept for the ensuing month. The result was a revelation—28,400 cu. ft. of oxygen were saved! In other words, risers are now being cut with half the amount of oxygen formerly used.

Besides this, other savings were effected. By using correct tip and oxygen pressure the operators were enabled to cut off the risers closer to the casting, thus eliminating a considerable amount of grinding. In fact, it was possible to use a portable hand grinder on many castings which had previously required the use of a large swinging grinder. Furthermore, a smaller number of cutters being found necessary, it was possible to release men from this work for other jobs about the plant.

This investigation and revision of methods, suggested by the Linde service operator, saved oxygen, labor and time for the steel foundry.—*Oxy-Acetylene Tips.*

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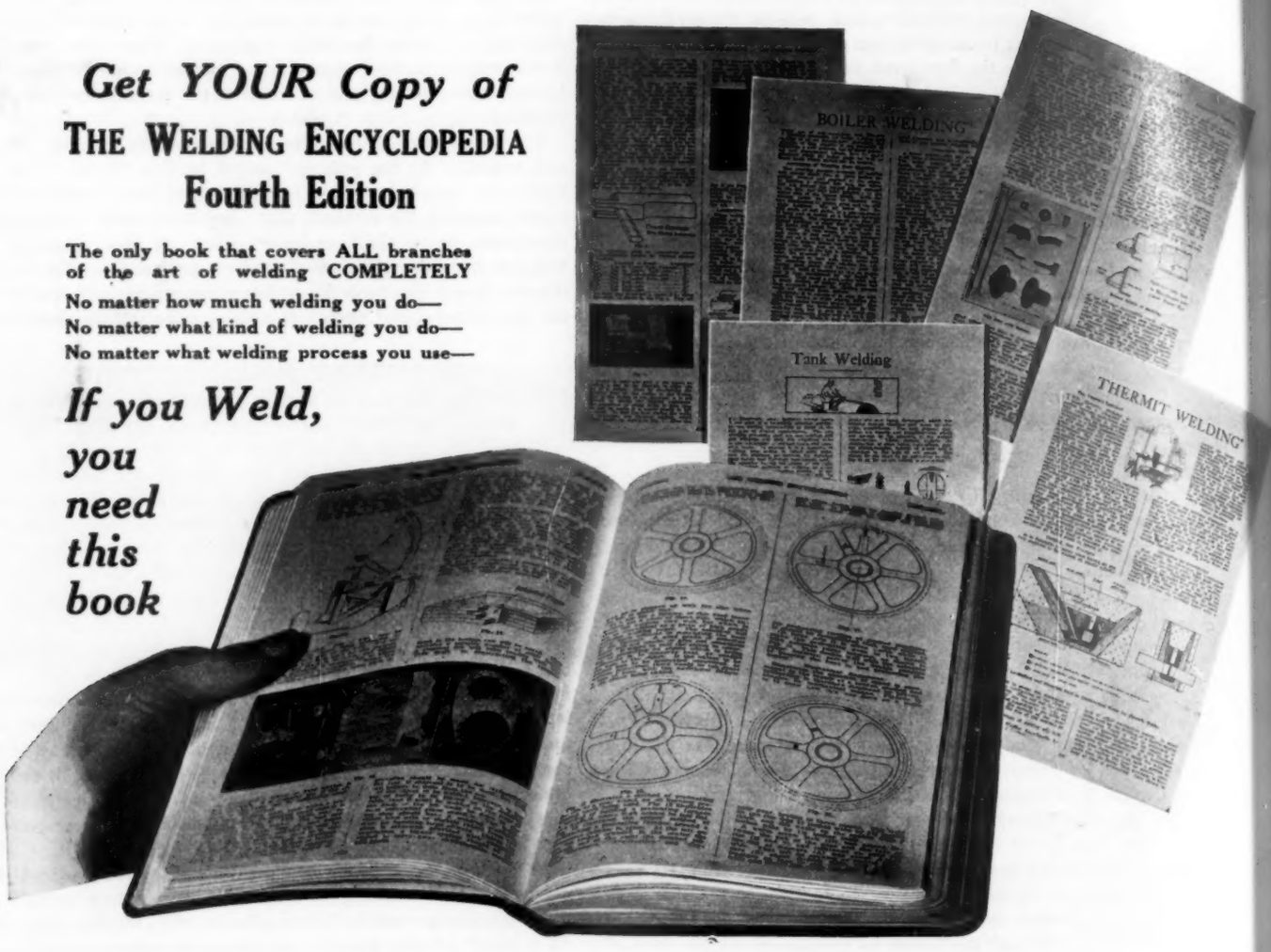

THE WELDING ENCYCLOPEDIA, Fourth Edition
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Expert advice at your finger tips

It serves every possible need for information on all of the welding processes. Whether your shop is engaged in production welding or repair welding, or both, whether you use the processes for only one metal or for a variety of different metals and different types of joints, **The Welding Encyclopedia** furnishes you with expert advice which pays for itself by increasing the quality of your work. **The Welding Encyclopedia** is not restricted to the welding knowledge that can be imparted by a single writer. On the contrary, each subject is discussed by a recognized authority on that particular subject. About fifty of the best known authorities on welding subjects in the world have contributed the results of their experience and research along special lines.

In compiling **The Welding Encyclopedia** the editors have had put at their disposal a vast fund of information which could not be made available through any other source. The result is a single volume covering the entire range of problems which can arise in the application of any of the welding processes, and this information has been so carefully arranged and cross-indexed that any portion of it is instantly located.

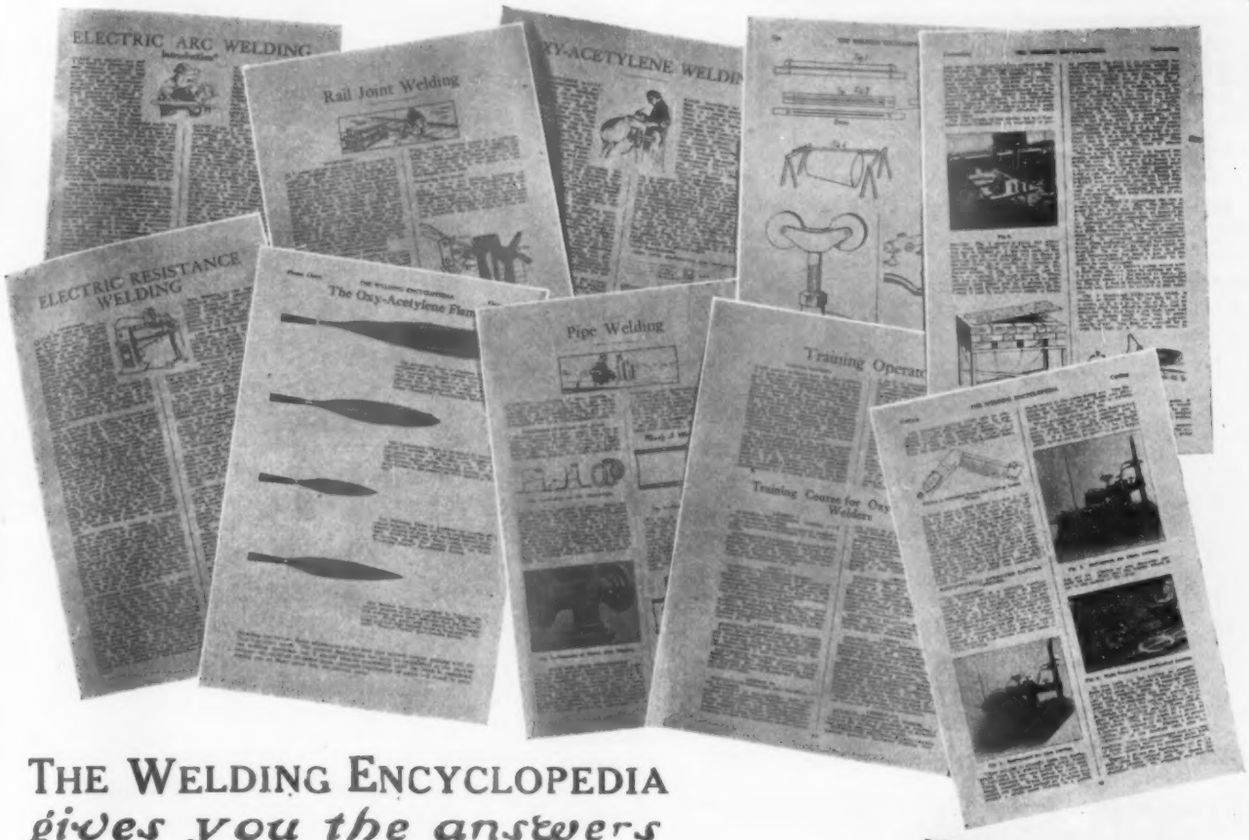
The Welding Encyclopedia describes in detail the theory and practice of every welding process, and tells how to weld every weldable metal by each of these processes, giving detailed instructions for handling such important welding jobs as boiler welding, sheet metal welding, tank welding, pipe welding, automobile welding, cutting, rail joint welding, railroad welding, etc.

It tells how to prepare parts for welding, how to preheat, how to anneal, how to test welds and how to select welding material. It explains the meaning of all words and terms found in welding literature. It gives the trade names of all products used in the welding industry, giving the name and address of the manufacturer in each case.

It tells how to take care of welding equipment so as to get the best results from it and keep maintenance costs down. It gives the latest revised federal, state and insurance rules and regulations for the installation of welding equipment, and its application to important work. There is also a splendid collection of charts and tables used for welding information, grouped together for convenient reference.

A valuable feature of The Welding Encyclopedia is the chapter on the training of operators. This chapter outlines lessons, exercises and examinations for a complete course in both oxy-acetylene and electric arc welding. Throughout these instruction courses references are supplied to the instructor and student so that they may find instantly the portions of the text which cover the topics in the outline.

The text is profusely illustrated with photographs and drawings made especially for **The Welding Encyclopedia.** No detail has been overlooked which could make The Welding Encyclopedia more complete and practical.



THE WELDING ENCYCLOPEDIA
gives you the answers

The editorial office of **The Welding Engineer** is recognized as the headquarters for authoritative information and help on all branches of welding, and conducts a large volume of correspondence helping welders and welding departments out of their difficulties. In a period of eight months it was found that 95% of the problems submitted to this office were answered directly from the pages of **The Welding Encyclopedia.**

Think of the time all these welders would have saved by providing themselves with a copy of **The Welding Encyclopedia** in advance! **Don't wait** until you get into trouble, or run up against a hard welding problem, but get the information in your hands **now.** Then, when you want it, it will be instantly available.

Whatever your troubles may be, you will find that **The Welding Encyclopedia** furnishes expert advice and instruction.

The table of contents below can give you only a very general idea of the scope of this work. Send for the book and give it a careful examination. We guarantee that it will be fully satisfactory and if not we will cheerfully make a refund. **Send the coupon today.**

CONTENTS

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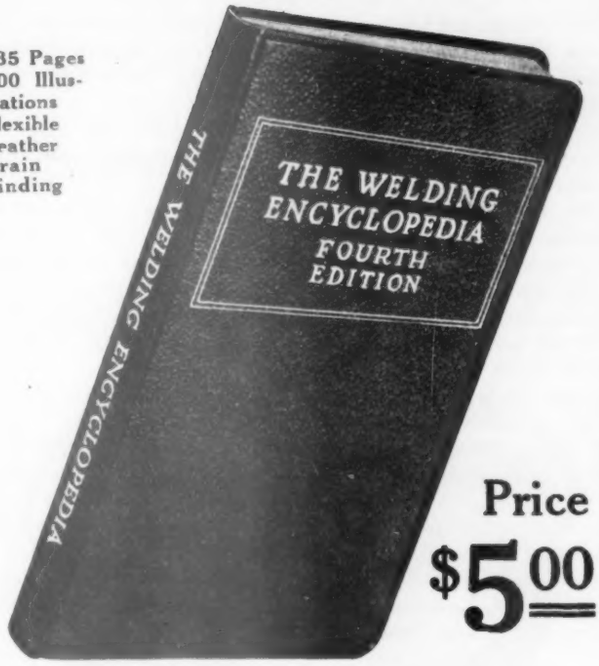

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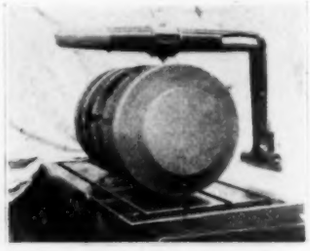
HERBERT PENDULUM HARDNESS TESTER

Two new developments of the Pendulum Hardness Tester will be exhibited in the stand of Edward G. Herbert, Limited, Manchaster, England, in the Machine Tool Trades Exhibition, London, held in September.

The Pendulum Operating Stand is specially adapted for inspection testing where a large number of tests must be effected rapidly. It is also claimed to enable "time tests" to be made without previous practice. The standard pendulum is used, and the operation is entirely mechanical. Slight movements of one handle serve:

1. To release the table and allow it to rise until the pendulum swings gently on the work.
2. To operate the stop watch.
3. To lower the table and replace the pendulum on its 3-point support.

Pendulum Operating Stand



24 Kilogram Hardness Testers

The arm supporting the pendulum can be raised to admit specimens up to 6 inches deep. A ball pointed diamond can be supplied for inspection testing on hardened steels.

The table is mounted on a plate which rests on three leveling screws. It can be replaced by special fixtures for testing irregularly shaped work.

The standard pendulum can be used to make time tests on this stand and also to make "scale," "work-hardening" and temperature tests by hand operation.

The 24 Kilogram Pendulum Hardness Tester is identical in principle with the standard 4 kilogram pendulum, but is adapted for testing very large work. With it hardness tests can be made:

On shafts or rolls up to 30 inches in diameter.

At any point on plates or other flat surfaces 30 inches wide.

At any point on the face of gears or drums of any diameter and 30 inches wide.

Inside a hole such as the bore of a gun or a large bearing.

The pendulum weighs 24 kilograms and is pivoted on a steel ball 3 millimeters in diameter. Adjustable weights are provided whereby the center of gravity of the pendulum can be brought to the center of the ball, and a central weight mounted on a micrometer screw provides for adjusting the length of the pendulum.

The 24 Kilogram Pendulum is adapted for making time tests for identation hardness, scale tests for work-hardness, and for measuring the work-hardening capacity of metals.

News of the Welding Trade

The Gibb Instrument Company, of Bay City, Michigan, has appointed Mr. F. J. DeLima as agent for the sale of their line of electric welding and electric heating machines in the Dominion of Canada. Mr. DeLima's headquarters are in the Keefer Bldg., Montreal.

The Presto-O-Lite Co. of Canada, Ltd., 110 Elm Street, Toronto, manufacturer of automobile lighting systems, welding machinery, etc., is building an addition to its plant. Wells & Gray are general contractors.

The Thomson Electric Welding Co., Cincinnati, has preliminary plans for the establishment of a new plant at Lynn, Mass., where an experimental works is now being operated. Negotiations are said to be under way for the acquisition of the former factory of the Campbell Electric Co., Stuart Street, Lynn. The present business in Cincinnati will be removed to the new location.

The Pacific Gas & Electric Co., 445 Sutter Street, San Francisco, will soon ask bids on a general contract for its proposed mechanical works at Emeryville, Cal., consisting of machine shop, foundry, electrical shops, metalworking shops, warehouse and storage yards, estimated to cost $500,000, with equipment. The engineering department of the company is in charge.

Harvey H. Johnson announces his resignation from the office of treasurer and director of the Alexander Milburn Company of Baltimore, Maryland, this resignation effective August 16th, 1924.

The American Foundrymen's Association is going to hold its annual convention and exhibits at Milwaukee, Wis., from October 11th through the 17th, inclusive.

The American Society for Testing Materials has just published bulletins covering their twenty-seventh Annual Meeting.

The Marmon-Harrisburg Company, Harrisburg, Pa., recently organized to represent the Marmon automobile in this section, has acquired the plant and equipment of the Keystone Electric Welding & Brazing Company, 2424 Raleigh Street, and will operate a general service and repair works at this location. Later expansion is planned. S. P. Nissley is president and general manager.

R. J. Elliott, purchasing agent of the Northern Pacific, with headquarters at St. Paul, Minn., has been placed in charge of the purchasing and stores department to succeed F. G. Prest, director of purchases, who has retired under the pension rules after 44 years of continuous service with this company.

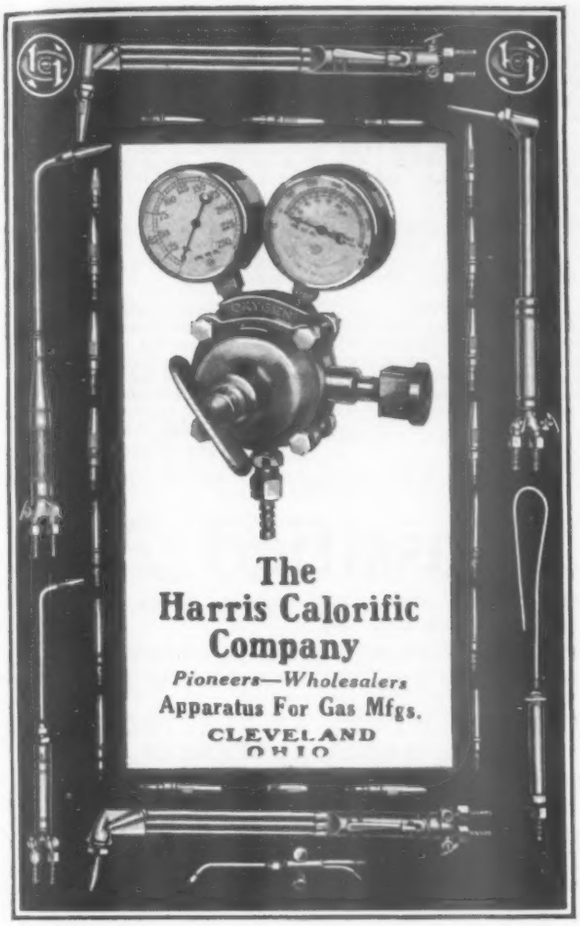
The compilation and publication of a complete catalog of the various kinds of castings into which manganese steel can be incorporated has recently been completed by the American Manganese Steel Co., Chicago Heights, Ill. The company claims that this is the first time that such a complete compilation has been printed. It is a general catalog, designated as No. 9, and is one of a series of nine publications. It is well illustrated and attempts to cover the entire ground so far as the unusual and diversified character of the manganese steel foundry industry permits.

The general sales agency for Crown Aluminum Solder manufactured by the Crown Aluminum Solder Company of New York has recently been taken over by the Central Steel & Wire Company.

The American Society for Steel Treatment will hold its convention on the Commonwealth Pier, Boston, this coming September 22 to 26.

The Gas Products Association announces that the Dayton Oxygen & Hydrogen Products of Dayton, Ohio, has recently been elected an active member and that the Liquid Air, Ltd., of Queens Park Works, London, N. W. 6, has recently been elected an associate member. The Liquid Air, Ltd., manufactures generators and liquifaction plants and also a line of apparatus.

The International Oxygen Company has recently published a pamphlet concerning Sun Ray Acetylene which they manufacture.



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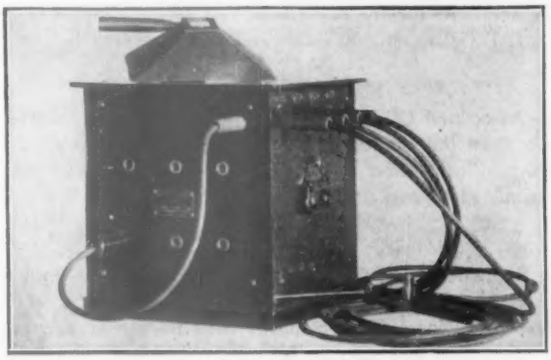

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2300 Warren Ave. Chicago, Ill.

Contract has been let by the Westinghouse Electric & Manufacturing Company. East Pittsburgh, to the Scholl Wolfe Company, West Fourth Street, Mansfield, Ohio, for the erection of a one and four-story addition to its Mansfield works, 160x360 ft., for which foundations will be laid at once. Bernard H. Prack, Martin Building, Pittsburgh, is architect and engineer.

The Chattanooga Boiler & Repair Company, Chattanooga, Tenn., recently organized with a capital of $25,000, will operate a plant in the Alton Park section for boiler repair work. A department will be arranged for the manufacture of smoke eliminating equipment. J. J. Gallagher, 210 Baldwin Street, is president.

The Associated Oil Company, San Francisco, has secured permission from the Board of City Trustees, Auburn, Cal., for the construction of a new storage and distributing plant on local site, estimated to cost $100,000, with equipment.

The Smith-Heylandt Company has been organized with a working capital of $500,000 and offices at 2633 Fourth Street S. E., Minneapolis, Minn. This company will take over the patents, importation, sale and distribution of the Heylandt apparatus for the manufacture of oxygen and other gases by the liquefaction process. E. H. Smith, president of Smith's Inventions, Incorported, and the Commercial Gas Company, Minneapolis, is president of the new organization; J. R. Miles is secretary.

E. J. McVeigh, general storekeeper of the Central region of the Canadian National, with headquarters at Toronto, Ont., has been appointed superintendent of reclamation and scrap, with headquarters at Montreal, Que., a newly created position.

At the annual autumn meeting of the Institute of Metals, to be held in London, Sept. 8 to 11, the third autumn lecture will be delivered by W. M. Corse of the National Research Council, Washington, who will take as his subject "Recent Developments in Non-Ferrous Metallurgy in the United States With Special Reference to Nickel and Aluminum-Bronze." The lecture will be illustrated by motion pictures.

CURRENT WELDING LITERATURE

NATIONAL CARBON COMPANY, INC., Cleveland, Ohio—A new catalog in a special binder and not only devotes more space than ordinarily to carbon brushes but includes other carbon products and goes very thoroughly into the technical side of brush operation. Considerable space is devoted to the discussion of the physical characteristics of brushes, brush recommendations, how to order brushes, description of brush grades, special brushes, location at which shunts should enter brushes, standard shunts, standard terminals and cables and special data as to aid in the selection of brushes for special purposes.

OXY-ACETYLENE MACHINE WELDING—The application of automatic machines and single and molded frame welding torches to production work, from a paper read before the Internatonal Acetylene Association Convention in Chicago by Fred E. Rogers of the Air Reduction Sales Company of New York City. Progressive welding of tubes without filler rod; special tube and shape welding; progressive corner welds; progressive welds of plates and drums without filler rod; edge preparation; progressive welding with filler rod; simultaneous or compression welding.—Industrial Gases, June, 1924.

OXY-ACETYLENE CUTTING OF STEEL—First part of an article to be continued in the Acetylene and Welding Journal. July, 1924. This paper was prepared by M. Piette and read before the 8th International Acetylene and Welding Congress. This paper takes up excessive pressure and the bore of cutting nozzles in detail. The paper is to be continued in the August issue.

WELDING OF GAS IRON FROM METALLURGICAL POINT OF VIEW—by J. G. Pearce, lecture delivered to British Acetylene and Welding Association, discusses influence of carbon upon iron and rate of cooling on structure; also goes into discussion of white and gray iron. Article is not complete and to be continued.—Acetylene Journal, September, 1924.

ELECTRIC GRINDERS, BUFFERS AND POLISHERS—The Cleveland Armature Works, Inc., 4732-4736 St. Clair Ave., Cleveland, Ohio. Catalog No. 315 has been issued and contains the full list of C.A.W. products including a variety of grinders, buffers and polishers. The catalog is well illustrated with halftones, sectional drawings and diagrams. Specifications for the various machines are also given.

APPLICATIONS OF OXY-ACETYLENE WELDING AND CUTTING IN INDUSTRAL PLANTS, welded condensers, evaporators, heat interchangers, coolers, separators, strainers and gas traps discussed in detail.—Acetylene Journal, September, 1924.

MANGANESE STEEL CASTING—Catalog No. 3 of the American Manganese Steel Company describes Manganese steel casting used in contractors' equipment. This booklet is attractively illustrated and contains much worth while information.

SEAMLESS STEEL CYLINDERS—This is a new catalog recently published by Janey, Steinmetz & Company, 30 Church St., New York City. This pamphlet deals with their entire list of equipment and supplies. In addition it contains rules for safe handling and storing cylinders containing compressed gasses, rules for handling oxygen cylinders and rules for handling anhydrous ammonia cylinders and treatment of persons exposed to ammonia fumes.

(*Continued on page* 48)

Classified Ads

Help Wanted—75c per line, minimum 4 lines
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

CARBIDE WORKS AT ELECTRONA, TASMANIA, AUSTRALIA

Offers are being called until September 30th, for the purchase as a going concern of the assets of the Carbide Works, Electrona, Tasmania, Australia.

There is a deep water port at Electrona, and the Works are producing about 4,500 tons per annum—approximately the Australian total demand for Carbide.

The Electrona Works are the sole manufacturers in Australia of carbide. There is a heavy customs duty on the importation of this material into Australia.

Full particulars regarding these Works can be obtained from the Australian Commissioner's Office, Room 1014, 44 Whitehall Street, New York City.

Wanted—To hear from man who has a rebuilt or used Lincoln or U. S. L. Electric Arc Welder. Must be in first-class condition and worth the money asked. No attention paid to inflated values. Fully described in first letter. Address, Modern Welding Co., 140 N. Jackson St., Decatur, Ill.

Position Wanted—By an allaround first class acetylene welder. Especially experienced on aluminum work. Some experience on electric arc welding and thermit welding. Address 31 care The Welding Engineer.

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A number of pages have been selected from THE WELDING ENCYCLOPEDIA, Third Edition, and published separately in the form of an instruction manual for welding operators. This manual contains lessons, exercises and examinations on oxy-acetylene welding and electric arc welding. It contains a color chart showing the appearance of metal at different temperatures, a color chart showing the appearance of the oxy-acetylene flame at different adjustments and two pages of illustrations showing step by step the procedure to be followed in setting up oxy-acetylene apparatus. This little booklet will be found invaluable to welding instructors, welding foremen, welding supervisors and welding students. It will be sent free to you upon request.

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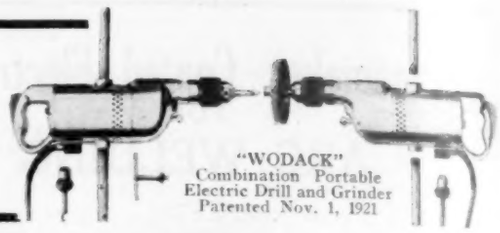

"WODACK"
Combination Portable
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Patented Nov. 1, 1921

CURRENT WELDING LITERATURE

(*Continued from page 46*)

PROPOSED SPECIFICATIONS FOR NON-FERROUS WELDING RODS FOR GAS WELDING—The Federal Specifications Board has drafted a proposed specification for welding rods. They desire industry criticism. Copy of these specifications can be obtained from the Secretary of the Compressed Manufacturers' Association.

OXY-ACETYLENE WELDING IN AUTOMOBILE INDUSTRY—Discussion of tremendous progress in application of welding in the automobile industry. The welding of wheels taken up in detail, operation by operation.—Acetylene & Welding Journal, August, 1924.

CONDENSED SHIPPING RULES FOR COMPRESSED GASES—Interstate commerce regulations for the transportation of compressed gases by freight, express and baggage have been compiled in condensed form. This compilation comprises all those parts of the present regulations relating to compressed gases and gives a set of regulations much more definitely referred to than the present ones.

RESISTANCE WELDING TRANSFORMERS—The Resistance Welding Committee of the American Bureau of Welding is taking up the question of standards, including the basis of rating of resistance welding transformers. This article discusses the electrical parts of the electric welder; the question of improper rating; design of primary; design of secondary; loose core, etc.—Acetylene & Welding Journal, August, 1924.

USE OF SUBAQUEOUS TORCH—Cutting of steel piling in construction work in Brooklyn, N. Y., together with other applications of the use of oxygen in under water cuting.—Compressed Air Magazine, August, 1924.

FLUX USED IN WELDING METALS, by Prof. F. C. Thompson—A discussion of the electric welding of mild steel and the advantages of the flux in helping to maintain the arc. A discussion of the covered electrode from the point of view of protection of the metal from oxidation. A discussion of acetylene welding and the influences of various fluxes upon it.—Acetylene & Welding Journal, August, 1924.

WELDING AND CUTTING FOR THE MANUFACTURE AND MAINTENANCE OF CHEMICAL EQUIPMENT—This discusses the application of the oxy-acetylene process to chemical operations. By chemical equipment they mean equipment used for all operations where the chemical nature and not merely the physical form of the substance is changed, equipment to treat valuable varieties of all kinds, as in oil refineries or gas plants, canneries or paper plants, or to prepare foods in packing house canneries or sugar mills. This discussion is very complete in every way and takes up the matter of digesters, which are often called cookers, which perform an operation closely allied to leaching or dissolving. Next alloy vessels or vats of sheet, copper and aluminum sheet are discussed. Stills, heat coilers, retorch, driers, absorbers, are taken up in detail with numerous good illustrations and diagrams. Pipe, steam jacket pipe, acid lines, condensers, separators and storage tanks are next discussed, also with profuse illustrations. The last of the discussion is given over to expermental and research work, engineering advice, etc.—Oxy-Acetylene Tips, September, 1924.

REACTIONS—The second issue 1924 of the quarterly publication distributed by the Metal and Thermit Corp. contains the following articles: Thermit Marine Repairs Approved by Lloyds Register of Shipping; Special Car for Thermit Crew; Thermit Welds Made for Large Steel Company; Marine Weld Saves Tow of Over Two Thousand Miles; Repairs Made in Pittsburgh District; Use of Thermit Welding for Construction of Special Work; Large Gear Repair; Welding Conductor Rails; Refrigerator Pipe Welding; Welding in Industrial Field; Welding Big Steam Hammer; Reclaiming Street Car Truck Frame; Thermit Welds Emergency Job; Locomotive Frame Welds. These articles are all very well written and attractively illustrated, showing the wide range and application of Thermit Welding.

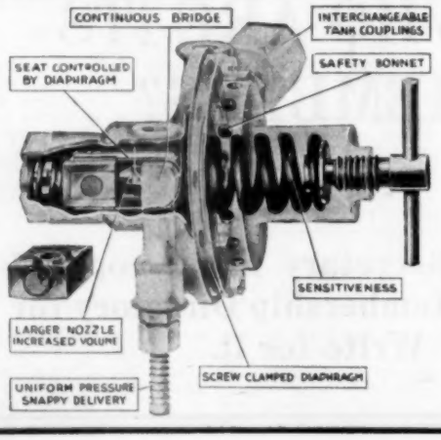
JOURNAL OF THE AMERICAN WELDING SOCIETY—The August, 1924, issue of the Journal of the American Welding Society is given up to a membership directory which deals with the American Welding Society, its functions, activities, membership, meetings, etc. It contains an alphabetical list of members and a geographical list of members. It makes a very valuable reference book.

PRECISION ELECTRIC WELDING, by S. W. Mann—Growth of electric welding and welding in general. Class of work done coming under the head of Precision jobs not only includes crank shafts of steel but cast iron and cast steel as well. Wherever a large amount of steel requires bending or twisting this term can be employed. Low voltage is preferable. Welding current should not exceed 150 amperes. Should be well regulated. Process of repairing crank shaft called Neutralized Precision weld. Discussion of how crank shaft is repaired and various other jobs are done.—Acetylene and Welding Journal, July, 1924.

OXY-ACETYLENE TIPS—Oxy-Acetylene Tips, The Linde Air Products Company, contains the following articles of interest to those in the welding trade: Oxy-Acetylene Process in the Refrigerating Industry, deals with the many advantages of the blowpipe in construction and maintenance of refrigerating plants due to extensive use of expensive fittings and headers, and the difficulty of doing away with leaky pipes and opening of screw connections; Welded Ventilation Systems, tight joints in air ducts are essential to long life and efficient operation; A Good Weld Holds, a description of a good welding job where a large casting stood up under overstrain which was so great that it caused a break in another place, shows how this work was done; Cutting Cast Iron With a Blowpipe, a description of several large jobs done; Welding in The Textile Mill, welding shop proves indispensable in keeping intricate machines in active service; Make It Yourself, ingenuity and welding make various sorts of special equipment; Another Use for Scrap Pipe, supports for shafting and pipe lines made from pipe in welding construction; Cutting and Welding in The Power Plant, the great utility of welding and its broad application where power is transformed and generated; Blowpipe Renews Mining Machinery, Keeping the Paper Mill Running, The Fabrication of Brick Machine Spouts, all discussed in Oxy-Acetylene Tips, August, 1924.

SURFACE GRINDING MACHINE—The O. S. Walker Co., Inc., Worcester, Mass. The single-stroke surface grinding machine arranged for motor drive with full explanation regarding each part is described in this catalog. In addition to the surface grinding machine are also descriptions of the Walker demagnetizer and the direct current generator. Plans for setting up the machines and specifications are also given.

OXY-ACETYLENE EQUIPMENT—this is the name of a 48 page booklet issued by the Oxweld Acetylene Company, Long Island City, New York. It deals in detail with their equipment for welding, cutting and brazing, lead burning, heating and decarbonising.



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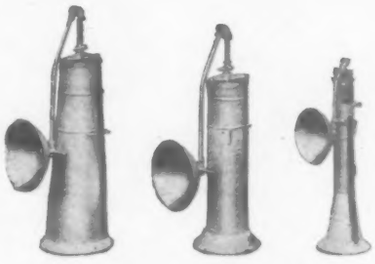

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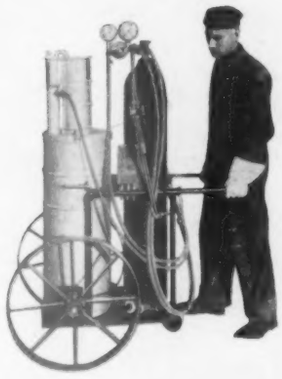

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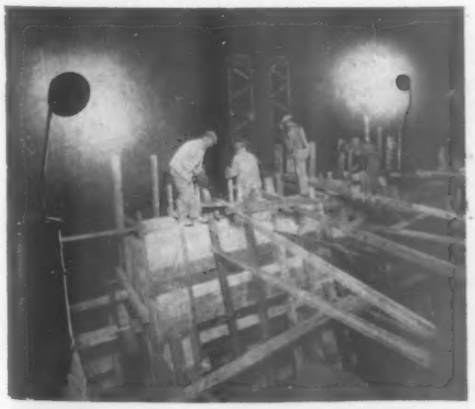

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